



THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE

Currents

spring 2017

HELICOPTERS & TERRAPINS

SHARE SPACE AT
NAS Patuxent River

Pilots & Natural Resources Staff
Find Creative Compromise &
Further Turtle Research

NAVFAC EXWC Tests Feasibility of Smart Water Conservation System
Navy Announces FY16 CNO Environmental Award Winners
NSWC Carderock & Department of Energy Host Wave
Energy Competition





THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE **Currents**

**Chief of Naval Operations
Energy and Environmental Readiness Division**

DIRECTOR

Rear Admiral Lou Cariello

DEPUTY DIRECTOR

Dr. Susan T. Goodfellow

DIRECTOR, COMMUNICATION AND OUTREACH

Kenneth Hess

kenneth.hess@navy.mil

703-695-5077

Currents Staff

MANAGING EDITOR

Bruce McCaffrey

Bruce McCaffrey Consulting, Inc.

brucemccaffrey@sbcglobal.net

773-376-6200

CONTRIBUTING WRITERS

Kathy Kelley

Cordelia Shea

ART DIRECTOR

Victoria Bermel

GRAPHIC ARTIST

Amy Jungers

DISTRIBUTION MANAGER

Lorraine Wass

ljwass@outlook.com

207-384-5249



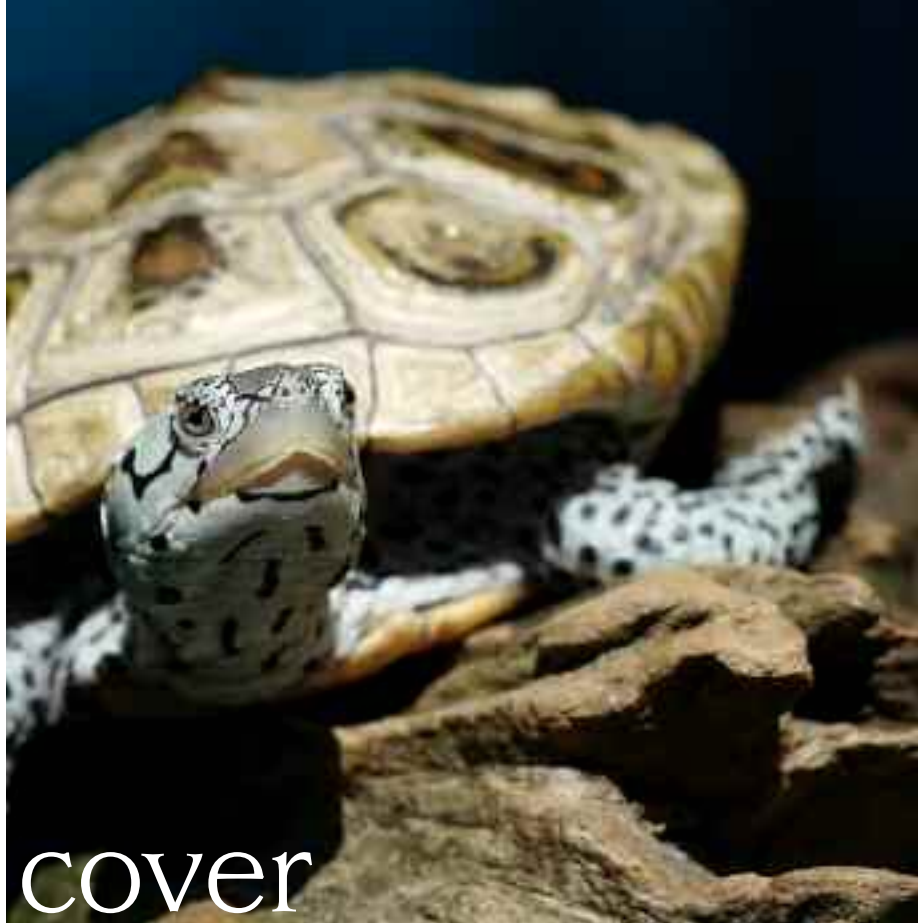
facebook.com/navycurrents



twitter.com/navycurrents



instagram.com/navycurrents



cover

When personnel from the Naval Air Station Patuxent River initiated efforts to survey and protect the Northern Diamondback terrapin, they worked with local helicopter squadrons to create, resource and execute solutions to balance turtle nesting requirements with pilot demands for suitable "confined area" landing zones.

4

Helicopters & Terrapins Share Space at NAS Patuxent River

Pilots & Natural Resources Staff Find Creative
Compromise & Further Turtle Research

Currents (ISSN 1544-6603) is the official energy and environmental magazine of the U.S. Navy, Chief of Naval Operations Energy and Environmental Readiness Division (N45).

This magazine is an authorized publication for members of the Department of Defense. Statements made in the N45 Outlook column reflect the official policy of the Navy. The contents in the remainder of the magazine are not necessarily the official views of, or endorsed by, the U.S. Government, the Department of Defense, or the United States Navy. Inclusion of any product or service in any *Currents* feature article does not constitute an endorsement by the Navy. The Navy encourages all readers to check with the appropriate supervising authority prior to using any product or service mentioned in the magazine.

Article submissions should be submitted directly to *Currents*' Managing Editor, Bruce McCaffrey, using the *Currents* article template. A public affairs review must be completed before *Currents* management can consider an article for publication.

Browse the *Currents* archive at <http://greenfleet.dodlive.mil/currents>. Commands that receive hard copies can contact Lorraine Wass (ljwass@outlook.com) with requests for changes to mailing addresses and shipping quantities.

features

- 18 **Navy Announces FY16 CNO Environmental Award Winners**
Efforts Range from a Recycled Runway to Food Waste Diversion
- 36 **NAVFAC EXWC Tests Feasibility of Smart Water Conservation System**
System May Significantly Reduce Potable Water Consumption
- 44 **NSWC Carderock & Department of Energy Host Wave Energy Competition**
Aquaharmonics Claims \$1.5 Million Prize for Winning Prototype
- 52 **Coho Salmon Return to Restored Streambed Near Naval Base Kitsap Bremerton**
Species Swim Above Restored Culvert for First Time in Decades
- 54 **Jim Creek Old Growth Forest Protects Ancient Legacy**
Navy Personnel & Others Set Aside Old Growth Habitat Where Many Species Now Thrive
- 58 **SERDP & ESTCP Announce 2016 Projects of the Year**
Notable Efforts Include Research on Management of Munition Constituent Contamination



departments

- 32 **Energy Warrior**
- 49 **Trends of the Environment**
- 67 **Best Shots**

HELICOPTERS & TERRAPINS

SHARE SPACE AT
NAS Patuxent River



MH-60 Sea Hawk helicopter.
MC2 John Philip Wagner Jr.



Hatchling Diamondback terrapins released from a predator exclusion device (PED).
Maria Ceballos

Pilots & Natural Resources Staff Find Creative Compromise & Further Turtle Research

Helicopter pilots are not the only ones seeking out the “confined area” landing zones at Naval Air Station Patuxent River (NAS Pax River) Maryland. The Northern Diamondback terrapin (*Malemys terrapin terrapin*) favors some of the same characteristics of sites for its nesting areas. So when the NAS Pax River Natural Resources Program (NRP) initiated terrapin nest surveys and protection efforts, they worked with local helicopter squadrons to create, resource and execute solutions that balance mission demands and natural resources requirements.

THE BASICS ABOUT **Naval Air Station Patuxent River**

NAS PAX RIVER is located in St. Mary's County, Maryland. The primary areas surveyed for the terrapins fall within the main NAS Pax River and the Naval Recreation Center Solomons Island parcels. These two facilities are located on the Chesapeake Bay at the mouth of the Patuxent River and encompass roughly 7,000 (non-contiguous) acres and just over nine miles of shoreline.

NAS Pax River is home to the Naval Air Systems Command (NAVAIR) and Naval Air Warfare Center Aircraft Division (NAWCAD) headquarters. It also includes the U.S. Naval Test Pilot School (USNTPS) and Naval Air Station Patuxent River's Search and Rescue Team (NAS PAX SAR). The USNTPS is the only military test pilot school in the world that includes a rotary wing (helicopter) training syllabus, which includes instructing and demonstrating helicopter handling characteristics to the U.S. Navy, Army, Air Force, Coast Guard and allied nation exchange pilots.

Pax River's NRP falls within the Naval Facilities Engineering Command's (NAVFAC) Public Works Department, Washington region. The NRP is part of the Conservation and Environmental Planning Branch (Compliance Branch), along with Cultural Resources, National Environmental Policy Act compliance and Environmental Restoration programs. Its permanent staff has expertise

in fisheries, wildlife management, forestry, zoology, geology, ecology, wetlands and outdoor recreation.

The permanent staff is supplemented by part-time and temporary staff when activity requirements of the Conservation Branch periodically increase. Supplemental staff can include one to five seasonal temporary employees, one to two high school cooperative study students and one to two college interns per year. In recent years, these temporary employees have been brought in through the Student Conservation Association (SCA) and a Morale, Welfare and Recreation Work Wise Teens program. The SCA has provided resource assistants to the NRP since 1995.



Helicopter Training

Helicopter "confined area" landing zones aboard NAS Pax River are used by both the USNTPS and NAS PAX SAR. The USNTPS uses the landing zones to instruct and demonstrate helicopter handling characteristics to the U.S. Navy, Army, Air Force, Coast Guard and allied nation exchange pilots. The NAS PAX SAR team unit utilizes the landing zones to maintain proficiency in performing heli-

copter overland rescue operations in confined areas. Maneuvering a helicopter in confined areas demands an intense level of coordination between the pilot and crew, and must be practiced on a regular basis to maintain the skill required to safely and expeditiously perform these operations. Locations to conduct this training are confined to military installations.

SOME OF THE SAME **characteristics** THAT THE PILOTS FAVORED MADE THE AREA A PREFERRED TERRAPIN **nesting area** AS WELL.

Confined area landing zones have small yet sufficient openings in the trees and other vegetation to allow landing while also providing necessary training for challenging landing conditions. Areas can be within a ring of trees or on beach areas between trees and water. A favorite landing zone on NAS Pax River was near a beach and dune area that naturally had these characteristics.

Terrapin nest surveys revealed that it wasn't only the helicopter pilots who liked the area around the landing zone.

Some of the same characteristics that the pilots favored made the area a preferred terrapin nesting area as well.

Northern Diamondback Terrapins

Diamondback terrapins are North America's only estuarine turtle—able to tolerate a wide range of salinity levels. There are multiple populations found along the east coast, from Massachusetts to Florida, and into the Gulf of Mexico. The Northern Diamondback terrapin population has

long found the tributaries and marshes in Chesapeake Bay to be an ideal habitat mix of sandy beaches, moderate shoreline vegetation and salt marsh.

Preferred nesting areas for terrapins have loose sand or gravel that is easy to dig for a nest, open enough for sun exposure to keep the nests warm but with some vegetation to discourage predators and provide cooler margins. Proximity to marsh areas offers cover and feeding areas for terrapin hatchlings.



MH-60 Sea Hawk helicopter.

MC1 Benjamin A. Lewis

Northern Diamondback Terrapins IN MARYLAND

THE NORTHERN DIAMONDBACK terrapin (*Malaclemys terrapin terrapin*) is an iconic species in Maryland and the Chesapeake Bay. They are the official mascot of the University of Maryland and the state reptile. Terrapins were an abundant food source for Native Americans and early colonists living around the Bay. When they became the main ingredient in a gourmet soup harvesting soared, placing heavy demands on a species that is slow to mature and reproduce.



Although female terrapins might nest up to three times per season, egg and hatchling survival is perilously low.

Female terrapins in Chesapeake Bay mature between eight and 13 years old. Although they might nest up to three times per season, egg and hatchling survival is perilously low. It is estimated that only two percent of eggs hatch. Eggs in unprotected nests fall prey to raccoons, foxes, skunks, ants, maggots and grass roots. The hatchlings that make it out of the nest frequently are eaten by gulls, crows, herons and other predators.

Those terrapins that survive then face additional human threats from crab pots, boat propellers, illegal harvest for food and pet sales and habitat loss.

Climate change is contributing to habitat loss, posing multiple threats to the species. As water levels rise, the beaches and marshes that once provided nesting and feeding habitat are inundated. The rising waters also contribute to shoreline erosion, which landowners have often tried to address with bulkheads and riprap, effectively blocking access to nesting sites. Maryland's Living Shorelines Protection Act, passed in 2008, requires nonstructural stabilization measures for shoreline protection—one step toward protecting habitat of many species in Chesapeake Bay. For more information about living shorelines, visit <http://ccrm.vims.edu/livingshorelines/index.html>.



A hatchling rests on moss near the site of emergence.
Jenna Cole

Terrapin populations in Chesapeake Bay are known to have declined significantly over several decades, but clear estimates of their numbers are elusive. Threats to terrapins once included over-harvesting and continue to include habitat loss, climate change, invasive species, predation, drowning in crab pots and boat propeller strikes. Some states, including Maryland, have been sufficiently concerned about declining numbers that they have prohibited or limited commercial harvesting and now require that crab pots include by-catch reduction devices (devices are effective at letting crabs in but keeping terrapins out). Concern for the species is also reflected by its listing in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Appendix II) which regulates their export.

NAS Pax River has suitable terrapin habitat and the species is listed as an occurring species in the installation's Integrated Natural Resources Management Plan (INRMP). Lacking any federal or state designation as threatened or endangered, surveys to determine numbers and locations of nests are not mandated. However, during meetings among natural resources agency partners to discuss INRMP updates, the U.S. Fish and Wildlife Service and Maryland Department of Natural Resources representatives noted that survey data from NAS Pax River would be a valuable contribution to ongoing terrapin research.

Survey data FROM NAS PAX RIVER WOULD BE A VALUABLE CONTRIBUTION TO ONGOING TERRAPIN **research**.

Nest Surveys

Coincident with the request to collect terrapin data on the installation, a new intern joined the base's NRP in 2013 through a SCA position. The intern, Sarah Funck, had a background in herpetology and was hired to prepare NAS Pax River's contribution to the Maryland Amphibian and Reptile Atlas, also called the "Herp Atlas." Because Funck also had conducted sea turtle nest surveys and was interested in terrapin habitat on the installation, she took the lead in initiating Pax River's Diamondback terrapin nest monitoring effort.

To address the scant information regarding the terrapin population at NAS Pax River, the project pursued four objectives:

1. Identify important nesting sites used by terrapins.
2. Quantify current nest predation rates.

3. Evaluate the success of predator exclusion devices.
4. Document nest survivorship using hatching success calculations.

To be able to cover the most suitable nesting habitat on the base, Funck needed help. She recruited and trained volunteers, both civilian and military, who could participate in daily beach surveys to locate nests. In 2013, the project's first year, nesting surveys started on 1 June and happened every day, seven days a week. In subsequent years, the starting date moved to 1 May, with volunteer training starting in April. Volunteer numbers ranged from 30 regular participants to as many as 100 registered participants.



An undisturbed terrapin nest
(prior to excavation).

LS2 Robert Russell



A Diamondback terrapin nest that has been
excavated and documented prior to reburial.

LS2 Robert Russell

Turtle, Terrapin, Tortoise

THESE THREE TERMS are common names for related species. All are reptiles that fall within the taxonomic order *Testudines*. Tortoises are typically thought of as land dwellers, but some land-dwelling species within *Testudines* are referred to as turtles (e.g., box turtles). In a general sense, turtles (including terrapins) spend most of their time in water. Sea turtles live in marine waters, while most other turtles live in fresh water. Terrapins can tolerate a wide range of salinity from sea water to fresh water, although their typical habitat falls within brackish, estuarine waters that are a mix of sea and fresh water.

Terrapin is a common name believed to come from an Algonquian word for turtle. It typically refers to *Malaclemys terrapin*—a species of turtle found in brackish waters along the east coast of the United States from Massachusetts to the Florida Keys and into the Gulf of Mexico.

To give some sense of the varied and changing terms associated with this order, the International Union for Conservation of Nature's Species Survival Commission has a Turtle Taxonomy Working Group (TTWG) that regularly revisits turtle taxonomy. The TTWG issued a seventh edition of its *Turtles of the World* annotated checklist in 2014 (available for download at www.iucn-tftsg.org/wp-content/uploads/file/Accounts/crm_5_000_checklist_v7_2014.pdf).

The survey teams focused on three areas of the installation—Beach House Beach, Hog Point and Cedar Point. Team members learned to look for sometimes subtle clues to nesting activity including crawl tracks and disturbed sand and gravel. If crawl signs were noted, volunteers cautiously searched for a nesting female to avoid interrupting egg laying.

On the rare occasion that volunteer teams came upon a nesting female, they would maintain a safe distance until nesting was completed. As the female left the nest, team members would then intercept the female to weigh and measure her. They also scanned her for any shell markings. Any markings found were recorded and if none were evident, new marks were added. These marks help researchers track females over time

and understand more about terrapin ages, nesting habits and nesting frequency.

When a nest was located, the team documented its location and habitat type.



THE ONCE-A-DAY EFFORT TO FIND NESTS DOUBLED TO **twice-a-day** WHEN IT WAS TIME TO **monitor** THE NESTS FOR HATCHLINGS.

The nest was carefully excavated to determine if the eggs could be counted, weighed and measured. If the eggs were still a pink hue they could be handled with extreme care using gloves. After data collection, eggs that were moved were replaced in the same order and orientation in which they were found and then reburied. If the eggs were a chalky white, they are left in-place to avoid disturbing the embryo.

Finally, the survey team would secure a crate (predator exclusion device) over the nest to protect it from predators. The crates were labeled with identification tags that included a nest number and estimated date of egg-laying. The crates also were equipped with wire mesh, or hardware cloth, that

would help to keep terrapin hatchlings inside the crate while also keeping raccoon paws out. For some nests, predators reached the nests before the survey teams. Nest location and predator tracks were recorded for these destroyed nests.

The once-a-day effort to find nests doubled to twice-a-day when it was time to monitor the nests for hatchlings. Estimated incubation time for terrapin eggs is 60 days and can vary depending on weather conditions. Teams would begin nest monitoring 50 days after the earliest nest had been discovered. Terrapin hatchlings can take several days to emerge from the nest after leaving the eggshell, meaning that an accurate hatching date could not be determined at the surface of the nest. To record an exact hatching date, the top egg of the nest was exposed once a day and then reburied and re-caged.

CONTINUED ON PAGE 14



A volunteer measuring terrapin eggs and collecting data.
LT Ryan Wu



An egg tooth on the tip of the hatchling's nose helps to break through the eggshell during hatching.
Jenna Cole



Nests need approximately 60 days to incubate before hatching occurs and can hold over 20 eggs.
Sarah Funck



A prototype of the new wire PED (left) and an original black PED.
Natasha Vila



MH-60R Sea Hawk helicopter.
Petty Officer 2nd Class Kevin V. Cunningham



A female Diamondback terrapin that
 has been captured, tagged and released.
LS2 Robert Russell



Hatchling terrapins that have
 just emerged from the nest.
LS2 Robert Russell



After being released from a PED, the hatchlings head into the nearby brush, quickly blending into their surroundings.

Natasha Vila



UH-72 Lakota helicopter.



Diamondback terrapins are about the size of a quarter upon hatching and have a myriad of obstacles to overcome as they grow.

Sarah Funck

MH-60 Sea Hawk helicopters.

MC3 Jameson E. Lynch



THE BASICS ABOUT **MH-60 & UH-72 Helicopters**

BOTH MH-60 SEA Hawk and UH-72 Lakota helicopters use the beach landing zones aboard NAS Pax River.

The Sea Hawk is twin-engine, medium lift, utility or assault helicopter used for anti-submarine warfare, search and rescue, drug interdiction, anti-ship warfare, cargo lift and special operations. The Sea Hawk is an airborne platform based aboard cruisers, destroyers and frigates and deploys sonobuoys (sonic detectors) and torpedoes in an anti-submarine role. These helicopters also extend the range of the ship's radar capabilities.

The Lakota is a twin-engine, light duty, unarmed helicopter optimized for routine air operations to include civil support, air transport, medical evacuation and search and rescue, in a permissive, non-hostile environment. The UH-72 is capable of transporting eight passengers or two stretchers and medical crew.



MH-60 Sea Hawk helicopter.



UH-72 Lakota helicopter.

CONTINUED FROM PAGE II

As hatchlings began to emerge from the nest, they were weighed, measured and then released on site. This could continue over several days until it was determined that any remaining eggs were no longer viable. Hatching success was measured by the number of hatchlings from a total number of eggs.

A Challenge Emerges

As demanding as the basic nest survey and monitoring efforts were, workload was about to increase. The project team returned to a nesting area to discover crates blown around the beach, up the dunes and into the water. This is when they realized the prime terrapin nesting area overlapped an established helicopter landing zone. Not only would the displaced crates not protect the nests, they posed a “foreign object debris” hazard to the helicopter crews.

Officials with the air station's NRP and the NAVAIR Ranges Sustainability Office met with helicopter squadron leadership to discuss the survey objectives and request that the helicopter pilots use other landing zones during the nesting season. At the time, NAS Pax River

had three “confined area” landing zones for helicopters, however, because of resource limitations, it was not possible to maintain two of these three sites and they became overgrown. The beach landing zone was the only real clear landing zone where the local helicopter squadrons could practice.

Due to the limited number of accessible landing zones, an initial compromise was reached. Pilots would try to reduce the demands on the specific landing zone but that when it was needed, the nest cages had to be temporarily removed. Until an alternative could be found, the NRP staff agreed.

Although the compromise allowed the surveys to continue, it generated additional tasks. During nesting season, the survey team would receive advance notifications anywhere from eight hours to 30 minutes before cages needed to be removed. Team members would get to the landing zone to dig out the partially buried cages before helicopters moved in. They then needed to replace them before dark when predators would be more likely to dig up the eggs.

THE NEW SITE LET US DO OUR JOB OF SUPPORTING THE **mission** WHILE **saving** THE TURTLES.—KYLE RAMBO

Seeking Solutions

After multiple survey seasons, NRP staff devised an approach to establishing an acceptable alternative landing zone. The site needed to satisfy many of the characteristics the helicopter pilots wanted for their turf landings but not serve as prime nesting habitat for the terrapins. One challenge was clearing vegetation and leveling the landing area to meet specifications. These included size, shape, surface type and obstructions preferred for pilot training.

When station funds and the acquisition process could not be relied upon to clear these other two sites, the NRP staff cleared them. Although NRP staff could clear the vegetation, they needed bigger equipment to fill and level holes and ruts so that helicopters could land safely. They also had limited time to complete the work before the next nesting season began.

When on-base construction crews could not get heavy equipment to the site within the timeframe, NRP looked for a different approach. As Kyle Rambo, Director of Environmental Planning and Conservation at Pax River, said “We needed a constructive, creative and flexible alternative.”

They turned to the installation’s Agricultural Out-lease farmer for help. Military installations, including NAS Pax River, can lease land to farmers for agricultural purposes that is not being used to support the mission. As part of the lease, the farmers can provide in-kind services. With smaller tractors and equipment, the farmer on Pax River accessed the existing overgrown, upland landing site and

completed the necessary work before the nesting season began. A new, comparable beach landing zone—complete with a terrapin exclusion fence to ensure the new site did not become a nesting area—was then brought on-line by NRP staff and SCA volunteers. By providing two alternate landing zones, beach access could be rerouted to a new landing zone until the nesting season was over—relieving some of the demands on the one useable “confined area” landing zone on the beach.

Rambo commented on the new site, “It didn’t deny access to areas the terrapins had used but did deny access to an area that might become attractive. The new site let us do our job of supporting the mission while saving the turtles.”



Terrapin hatchling
prior to release.
LS2 Robert Russell



Hatchling terrapin entering the
Patuxent River after being weighed and
measured by NAS Pax River volunteers.

Maria Ceballos

The Student Conservation Association & THE NAVY

THE SCA IS a national non-profit that engages both high school-age and young adult volunteers in conserving natural resources through internships, conservation jobs and crew experiences. Founded in 1957, the SCA has grown from 53 volunteers working in two national parks to nearly 75,000 members in 2014 across the United States. SCA has formed partnerships with governmental agencies, environmental groups and corporations. They complete projects in every conservation discipline, including ecological restoration, Geographic Information Systems/Global Positioning Systems, wildlife management and interpretation.

The Navy has employed several SCA interns on U.S. installations including:

1. NAS Patuxent River
2. NAS Jacksonville

3. Naval Station Guantanamo Bay
4. NAVFAC Northwest
5. NAVFAC Marianas
6. Marine Corps Base Camp Lejeune

The SCA also works with other Services within the Department of Defense. For more about SCA, go to their website at www.thesca.org.



Results & Value

During 2013, teams identified 98 nests, 97 of which were on Beach House Beach. They installed protective cages on 29 of the 98 nests. None of the protected nests were disturbed by large predators and, based on egg to hatchling counts, the hatching success of the protected nests was just over 93 percent. Of identified but unprotected nests, only five had successful hatches. Size and weight measurements were taken on 236 of the hatchlings. By 2015, teams caged 70 nests, which produced over 700 successful hatchlings. Measurements were collected on approximately 685 of those hatchlings.

Chris Rowe, researcher from the University of Maryland's Chesapeake Biological Laboratory, commented that the "NAS Pax River terrapin volunteer survey and nest protection program is important. Few populations or sub-populations in the Bay are currently being monitored, so the data they collect will be useful if we expect to evaluate population trends in the future."

He also noted that long-term data sets will be critical to characterizing population changes. "This is where efforts

like that at NAS Pax River are very important—if continued over a long enough period of time, trends may emerge that can inform scientists, regulators and conservationists of the trajectory of the population," said Rowe.

Jackie Smith, natural resources specialist at Pax River, pointed out that it is critical to have data on species that occur on the installation. It is important to know what direction a species population might be headed and to know if any other work being funded could affect it. "This kind of work helps us stay ahead and be prepared. It just makes sense."

Interns & Volunteers are Critical Assets

The labor-intensive nest and hatchling surveys could not be done without SCA interns and dedicated volunteers. The SCA interns provide a valuable supplement to NRP staff, spending 16-week assignments conducting surveys, outreach and field support on the installation.


THIS KIND OF WORK HELPS US STAY **ahead** AND BE PREPARED.
IT JUST MAKES **sense**.—JACKIE SMITH

Three interns—Sarah Funck, Michael Irvin and Natasha Norton—have supported the terrapin efforts. (For more on the SCA program and the Navy, see our sidebar “The Student Conservation Association & the Navy.”) The interns have helped to train and coordinate the volunteers who are then part of the survey

team. Volunteers have included individuals from all parts of Pax River, including the helicopter community, the Health Division, Pax River families and many others.

The teams go out in all weather, trudging across the sand and enduring the heat, wind and insects,

to help further knowledge about the Diamondback terrapin.

Smith noted, “The volunteer coordination efforts alone would tax the existing department workload. We could not do this project without the SCA interns and volunteers.” 

Jackie Smith
Naval Air Station Patuxent River
301-757-0007
DSN: 757-0007
jacqueline.c.smith@navy.mil



Navy Announces FY16 CNO Environmental Award Winners

Efforts Range from a Recycled Runway to Food Waste Diversion

VICE ADMIRAL PHIL Cullom, then-deputy chief of naval operations for fleet readiness and logistics (N4), announced 30 winners of the fiscal year (FY) 2016 Chief of Naval Operations (CNO) Environmental Awards competition in a naval message in March 2017.

The CNO Environmental Awards are an annual recognition program that highlights the accomplishments of nominated ships, installations and individuals for exceptional achievements in environmental stewardship.

The competition categories for the FY 2016 competition included natural resources conservation (large installation), environmental quality (industrial and overseas), sustainability (non-industrial and individual/team), environmental restoration (installation), cultural resources management (small installation and individual/team), environmental excellence in weapon system acquisition, environmental planning and afloat (includes five competitive sub-categories). (Note: No nominations were received in the environmental excellence in weapon system acquisition category.)

Subject matter experts from the Navy and other non-governmental organizations judged the individual nominations on accomplishments during the 1 October 2014 through 30 September 2016 eligibility period.

In the next tier of competition, the 30 winners will compete along with Marine Corps nominees for the Secretary of the Navy Environmental Awards.

Accomplishments of the winners are highlighted here.

Natural Resources

This award recognizes efforts to promote the conservation of natural resources, including the identification, protection and restoration of biological resources and habitats; the sound long-term management and use of the land and its resources; and the promotion of a conservation ethic.

Large Installation

Naval Air Station Fallon, Nevada

Naval Air Station (NAS) Fallon has won numerous environmental awards in the past, including five CNO Environmental Awards for Natural Resource Conservation. Accomplishments during the FY 2016 award period include three water catchment projects designed to provide access to water for the base's wildlife in this drought-prone area and the breaching of a levee to



Volunteers from the Navy, Nevada Department of Wildlife and Nevada Bighorns Unlimited added rock and cement to expand a water collection site at NAS Fallon. Bighorn sheep and pronghorn antelope use the water in this dry area.

Anna Keyzers

eliminate habitat for non-native species and prevent the spread of an amphibian disease. Also, working with the Naval Facilities Engineering Command (NAVFAC) Southwest's attorneys, the public works team determined that a private contractor had exceeded the terms of its easement by building a road through a sensitive wetlands area. The road was removed and the area restored to its natural state. All of these projects were collaborations with other local governmental and non-governmental organizations.

Naval Air Station Whidbey Island, Oak Harbor, Washington

NAS Whidbey Island is home to a sizable population of the Washington ground squirrel, a species that has been considered for listing as federally threatened or endangered. Due in large part to the base's monitoring and habitat enhancement efforts, in partnership with state and local partners, the U.S. Fish and Wildlife determined in 2016 that the listing of the Washington ground squirrel as federally threatened or endangered is not warranted. Other accomplishments included the relocation of five bald eagles as part of the Bird Aircraft Strike Hazard program, the planting of native Gerry oak trees and a partnership project with local Native American tribes to restore salmon habitat in the Crescent Creek area.



TOP: Washington ground squirrel with radio collar.

BOTTOM: Planting forbs for habitat restoration.



The High Water Mark initiative is a cooperative effort to build local awareness of flood risk by posting signs reminding residents of the Superstorm Sandy high water mark. Shown here are local and federal officials along with Captain Jay Steingold of NWS Earle.

Naval Weapons Station Earle, Colts Neck, New Jersey

Naval Weapons Station (NWS) Earle suffered almost \$50 million in damage during Superstorm Sandy, which raised awareness of the increasing need to adapt to climate change and sea level rise (CC/SLR). Therefore, NWS Earle embarked on a holistic shoreline management and resiliency program with multiple stakeholders and funding sources to address immediate environmental needs (increasing stormwater capacity to eliminate residential flooding) and the long-term challenges posed by CC/SLR. Rather than simply building a levee, efforts were focused on natural solutions including the restoration of marshes and the introduction of oyster beds, which minimize flooding in surrounding areas and improve fish habitat.

Environmental Quality

These awards recognize efforts to ensure mission accomplishment and protection of human health in the areas of environmental planning, waste management, and environmental law and regulation compliance. Meeting or exceeding all environmental requirements not only enhances the protection of our environmental assets, but also sustains the Department of Defense's (DoD) ability to effectively train and maintain readiness.

Industrial Installation

Fleet Readiness Center Southwest, San Diego, California

In FY 2016, Fleet Readiness Center Southwest (FRCSW) achieved 100 percent environmental regulatory compliance for all media programs and met or exceeded all



The Energy Management Control systems used in FRCSW industrial buildings reduce energy consumption and greenhouse gas generation. For example, the control system turns heating on and off for day and evening usage.

applicable Executive Order objectives and targets. One of FRCSW's most impressive achievements was the completion of a full upgrade of the Navy Primary Standards Laboratory including a top-of-the-line high efficiency chiller and compressed air system, and a light-emitting diode (LED) lighting retrofit. This has resulted in a utilities savings of \$100,000 and a 38 percent reduction in energy intensity in just one year.

Naval Air Station Jacksonville, Florida

In June 2016, NAS Jacksonville completed one of its largest construction projects in decades: the complete reconstruction of the main runway of Towers Field. This project recycled 100 percent of the asphalt and concrete debris from the construction, resulting in over \$7 million



A P-3C Orion takes off from the NAS Jacksonville runway in December 2015. The aircraft was the first one to take off from the newly renovated airfield.

Victor Pitts

savings in landfill disposal costs while at the same time reducing the need for raw materials. In FY 2016, the environmental team also recycled over 300 tons of materials through a qualified recycling program and converted 4,000 gallons of vegetable oil to biodiesel. Additionally, over 3,057 tons of metal were recycled, resulting in significant monetary credits.

Naval Base Kitsap, Bremerton, Washington

In the environmental planning area, Naval Base Kitsap (NBK) initiated 20 consultations in FY 2015/16 under the Endangered Species Act and 73 under the National Historic Preservation Act. Additionally, 133 letters were sent to tribes, either initiating consultations, or documenting progress made. Approximately 1,400 projects were reviewed for potential impacts to the environment. One of several of NBK's waste reduction efforts included the installation of hazardous material lockers for collection of excess hazardous materials from submarines, ships and other vessels. And to enhance environmental compliance, several projects were completed to enhance the strength and security of NBK's 286 above- and underground storage tanks, decreasing the likelihood of releasing fuel to the environment.



A new 10,000-gallon, double-walled fiberglass underground storage tank is being installed at NBK. The tank replaced a 38-year old single-walled tank at NBK that had reached the end of its life expectancy.

Thomas Harvey

Overseas

Camp Lemonnier Djibouti

The work and efforts of the Camp Lemonnier Djibouti (CLDJ) environmental division has saved about \$900,000, decreased waste by 1.5 million plastic water bottles and reduced Styrofoam container usage by 50 percent between 2014 and 2016. In an effort to reduce hazardous material disposal costs, CLDJ blended off-specification jet fuel (slated for disposal) with diesel to power the camp's incinerators, resulting in a yearly savings of more than \$92,000. Equipment was also purchased for in-house sampling of soil and water, thereby avoiding costly charges for environmental services.



CLDJ drinking water stations encouraged personnel to refill water bottles rather than use disposable bottles. The annual plastic bottle supply saving was over 1.5 million bottles.

Naval Air Facility Atsugi, Japan

In 2015, Naval Air Facility (NAF) Atsugi became the first overseas installation to implement environmental readiness manuals to each of its 13 tenant commands. In tailoring volumes of environmental code, plans and manuals to individual activities, each tenant command has a consolidated set of environmental regulations designed to apply to their specific activities. NAF Atsugi also completed a bee relocation project in partnership



NAF Atsugi's environmental team partnered with local beekeepers to relocate nuisance hives off base. This partnership greatly benefits local farmers while progressing DoD and Government of Japan initiatives.

Kaoru Saito

with the local government and community. This project, recognized with a CNO award in FY 2015, relocated two hives from the base to a nearby farm, saving an estimated 100,000 honeybees.

Naval Station Rota, Spain

In FY 2016, the Qualified Recycling Program at Naval Station (NAVSTA) Rota executed 15 direct sales agreements of recycled materials, saving over \$146,000 compared to Defense Logistics Agency contracting. During this period, NAVSTA Rota recycled 1,080 tons of



Community outreach efforts and new plastic and metal recycling bins have been instrumental in the success of the NAVSTA Rota recycling program.

Tim Uplinger

material that otherwise would have gone to landfills, the most ever recycled at the station. This translated to a one-year improvement in the landfill diversion rate of 21 percent (from 48 percent in FY 2015 to 69 percent in FY 2016). This increase can be attributed to the base's improved community outreach and education efforts.

Sustainability

These awards recognize efforts to prevent or eliminate pollution at the source, including practices that increase efficiency and sustainability in the use of raw materials, energy, water or other resources. Sustainable practices ensure that DoD protects valuable resources that are critical to mission success.

Non-Industrial Installation

Naval Air Station Whiting Field, Milton, Florida

Naval Air Station Whiting Field (NASWF), in coordination with the Secretary of Navy's Renewable Energy Program Office, finalized an agreement with Gulf Power Company

to construct an intermittent solar farm located on base. This farm will be one of three sites in the region that together have the potential to produce enough energy to power approximately 18,000 homes yearly. Other improvements include the installation of high-efficiency LED street and parking lot lights, the replacement of inefficient lighting fixtures in the mid-field hangar with fluorescent lighting fixtures operated by occupancy sensors and replacement of one 200-kilowatt diesel standby generator at the west water well with a 150-kilowatt natural gas standby generator.

Naval Hospital Bremerton, Washington

Naval Hospital Bremerton has partnered with the Stryker Corporation to collect and return Food and Drug Administration-classified "single use devices" used in the operating room instead of disposing of them as medical waste. In FY 2015 and FY 2016, almost two tons of these devices were recycled through this process, representing a cost avoidance of over \$2,000 in waste disposal. These devices are reprocessed and available for sale at a 50 percent savings over new items. The hospital also recycles



A medication disposal container at Naval Hospital Bremerton. The program accepts consumer unused or expired prescribed controlled and non-controlled medications, such as over-the-counter dispensed medications.

various non-invasive medical devices and has implemented a program to handle discarded medications. The hospital's very successful recycling program recycles everything from cooking oil to chemicals to light bulbs and sells many of the waste products to gain additional revenue.

Naval Support Activity Mechanicsburg, Pennsylvania

Naval Support Activity Mechanicsburg (NSA-M) has maintained a waste diversion rate of over 60 percent for the past six years and recycled over 9,500 tons of material during FY 2015-16. Their most impressive recycling feat was repurposing a demolished warehouse to build cabins at a Boy Scout camp. This single action kept over 325 tons of wood out of the landfill. Through various training activities, NSA-M reduced energy use by 7.8 percent and saved over \$3 million during the award period. This exceeded the Energy Independence and Security Act of 2007 energy goal. NSA-M also converted 20 buildings from central steam to boilers and added centralized controls, reducing greenhouse gas emissions by 12 million pounds and saving \$2.2 million a year.



Another NASWF innovation—a new water bottle filling station that displays the number of water bottles diverted from the solid waste stream every time someone refills a bottle.



This centralized networked control center optimizes building heating at NSA-M. In combination with new boilers, this project has resulted in a savings of \$2.2 million and 12.4 million pounds of carbon dioxide per year.

Individual/Team

Naval Base Coronado, San Diego, California

Recycling has picked up impressive momentum at Naval Base Coronado (NBC) in the last two fiscal years, thanks to the efforts of the NBC Sustainable Solid Waste program team. This five-person team implemented language in contracts to ensure that waste products are recycled or composted, and participated in a food waste study conducted by the NAVFAC Engineering and Expeditionary Warfare Center (EXWC). These efforts resulted in net savings of \$6,493,259 to the operations at NBC between FY 2015 and FY 2016, and increased the base's diversion rate to 55 percent, five percent over DoD goals. (See our sidebar "More Insights Into Naval Base Coronado's Win" at the end of this article.)



World War II era bunker at NBC's coastal campus shown prior to demolition. During the demolition, the concrete debris was separated from the rebar and stored onsite until equipment was brought onsite to process the debris to be used as base material.
Anne David

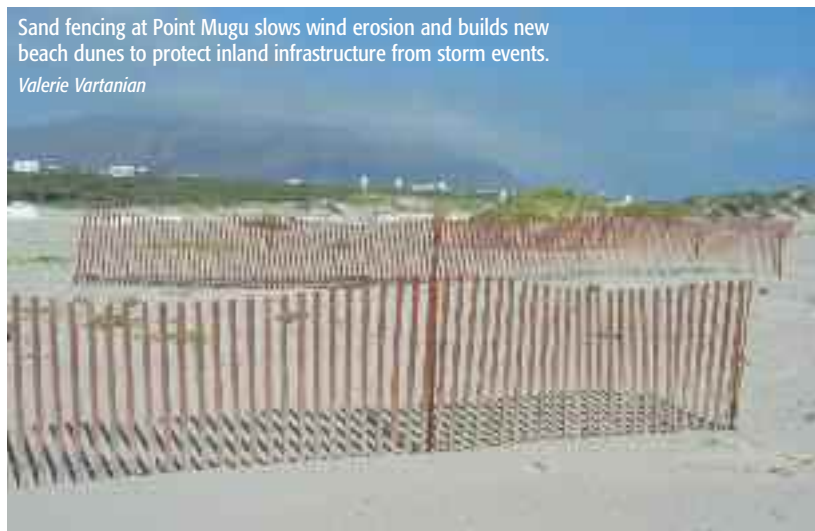
Naval Base Ventura County Sustainability Team, Point Mugu, California

Naval Base Ventura County's (NBVC) Environmental Management System is the fundamental mechanism for standardizing the methods and processes used to evaluate and address environment impacts across NBVC's three operating areas. The six sustainability team members work with 148 designated environmental coordinators from 61 tenant organizations and commands. This team observes, documents and audits NBVC operations and practices with potential impacts to environmental aspects. NBVC's Internal Assessment

Plan ensures that all facilities/operations are evaluated, root causes for environmental noncompliance are addressed and opportunities to further sustainability and pollution prevention goals are identified.

Sand fencing at Point Mugu slows wind erosion and builds new beach dunes to protect inland infrastructure from storm events.

Valerie Vartanian



NAVSUP Fleet Logistics Center Pearl Harbor, Hawaii

The six-member environmental team at Naval Supply Systems Command Fleet Logistics Center Pearl Harbor (FLCPH) is responsible for this command's environmental programs. In FY 2015 and 2016, FLCPH executed several energy conservation and xeriscaping projects, continued efforts to minimize purchase and storage of hazardous material throughout the region, collaborated with the U.S. Environmental Protection Agency (EPA) to improve opera-



Installation of translucent panels at FLCPH's material handling equipment building reduced overall lighting energy costs and improved the work environment.

Lieutenant Junior Grade Frances Hunter

tion and maintenance of underground storage tanks, and conducted several command engagement and community outreach events. These accomplishments were achieved during a period of significant funding and personnel hiring constraints.

Environmental Restoration

This award recognizes efforts to protect human health and the environment by cleaning up identified sites in a timely, cost-efficient and responsive manner. Restoring these sites impacted by historic defense practices protects military personnel and the public from potential environmental health and safety hazards.

Installation

Naval Base Point Loma, San Diego, California

The highlight of the Naval Base Point Loma (NBPL) Installation Restoration (IR) program during the award period was the successful reduction of indoor air trichloroethylene



The primary vapor intrusion entry point at NBPL (shown at left) was hidden behind a wall. Floor cracks, another potential entry point for vapors, were sealed with epoxy.

A. Lind



vapors within Old Town Complex Building 3 to below the EPA 8-hour exposure allowable limits, resulting in improved air quality and reoccupation of several office spaces. The innovative remediation design was recognized by the American Academy of Environmental Engineers and Scientists who awarded NBPL their Grand Prize award in the Industrial Waste Practices category in the 2016 Excellence in Environmental Engineering and Science international competition.

St. Juliens Creek Annex, Norfolk, Virginia

In 2000, 59 potentially contaminated IR and Munitions Response sites, solid

waste management units and areas of concern were identified for evaluation at St. Juliens Creek Annex. In May 2016, the Record of Decision for the final site under investigation was signed, and a preliminary closeout report was signed the following July, signifying "Construction Complete" for the facility. This designation indicates that all physical construction of all cleanup actions are complete, all immediate threats have been addressed and all long-term threats are under control for all portions of the site.



A chemist analyzes groundwater samples in the field using a portable gas chromatograph during an investigation at IR Site 2 at St. Juliens Creek Annex. While significant contaminant reduction has occurred, the site will undergo continued remedial action and monitoring.

Kathryn Smith

Cultural Resources Management

These awards recognize efforts to promote cultural resources stewardship by highlighting outstanding examples of cultural resources management. Awards are designed to showcase extensive cultural resources including archaeological sites, the historic built environment and cultural landscapes. Desired initiatives include partnering with external stakeholders such as Native Americans, state historic preservation officers and local communities, and those working with internal stakeholders, such as master planning, public works and range management. Through cultural resources management programs, Navy and DoD identify areas likely to contain historical assets and work to protect these resources for future generations in partnership with Native American tribes and historic preservation authorities.

Small Installation

Commander, Fleet Activities Yokosuka, Japan

Fleet Activities Yokosuka (FLEACT) Yokosuka's cultural resources include 35 archeological sites registered by the Kanagawa Prefecture, 260 historic buildings and other noteworthy monuments and infrastructure. During the reporting period, a new Historic Context and Inventory Report was compiled, evaluating each building and structure and assigning them a preservation rating of A through D. This rating system, which began in 2003, was introduced to other naval bases and is being utilized for most U.S. military bases in Japan. The Yokosuka Board of Education and NAVFAC Pacific assisted with this project, saving approximately \$20,000.



U.S. Forces Japan environmental subcommittee members tour the historic Yokosuka Dry Dock 1. Dry Dock 1 was recognized by the Japan Heritage program as an historic site. Completed in 1871, it is the oldest stone dry dock in Japan.

Izumi Morine

Naval Air Station Pensacola, Florida

With more than 25 percent of the buildings managed by NAS Pensacola determined eligible for or listed in the National Register of Historic Places, collaboration is crucial, and the Public Works Department is constantly planning for consultation. The Cultural Resources Manager (CRM) works on hundreds of cultural resources considerations a year, from large-scale design and construction projects to small renovations. Just one accomplishment during the awards period was the completion of a floating port security barrier (PSB). The construction of the PSB was completed on schedule despite the presence of a sunken caisson (circa 1830) discovered during dredging operations.



Ms. Carrie Williams, NAS Pensacola's CRM, reaches into a display case filled with old survey and engineering equipment and other historic artifacts. The case promotes cultural resources awareness and stewardship.

Norfolk Naval Shipyard, Virginia

Over the years, Norfolk Naval Shipyard (NNSY) has surveyed 77 percent of the installation and identified 18 architectural evaluations. During the award period, NNSY captured Geographic Information Systems data identifying new archaeological sites that require further investigations, developed a one-hour driving tour highlighting significant resources and held multiple cultural resource training sessions. Personnel also completed a comprehensive photographic archival study at the National Archives and Records Administration. This will streamline State Historic Preservation Office consultations, reduce the need for archaeological surveys and save the Navy time and money.



First constructed in 1835, NNSY's Building 3 is one of the oldest structures constructed by the Navy.

Individual/Team

Ms. Carrie A. Williams of NAS Pensacola, Florida

Ms. Williams is the Cultural Resources Manager for NAS Pensacola. Employed in 2010, she was the first full-time Secretary of the Interior-qualified archaeologist to manage installation cultural resources in Navy Region Southeast. Ms. Williams single-handedly manages the cultural resources program at NAS Pensacola which encompasses over 8,000 acres. NAS Pensacola implemented its first official Integrated Cultural Resources Management Plan (ICRMP) under Ms. Williams, who received support from the NAS Pensacola Commanding Officer, the Florida State Historic Preservation Officer (SHPO), and federally recognized tribes. Just one of her recent accomplishments is her consultation efforts with the SHPO which resulted in a No Significant Impact designation for a new solar facility on disused NAS Pensacola lands.



Carrie Williams discusses the ICRMP with Jon Hill, Executive Director of the Pensacola Lighthouse and Museum. Built in 1859, the lighthouse is a public use resource on the base.

Ms. Kerry A. Vautrot of Portsmouth Naval Shipyard, Maine

In May 2011, Ms. Vautrot became the first full-time Cultural Resources Manager for the Portsmouth Naval Shipyard (PNSY) Public Works Department. Her area of responsibility includes 19 Navy installations and reserve centers occupying more than 16,200 acres of land within six states across the Northeast. Ms. Vautrot is responsible for the management and implementation of three ICRMPs for



The Portsmouth Naval Cemetery is a small burial ground with 186 stones dating back to the 1820's. The cemetery is a contributing resource to the Portsmouth Naval Shipyard Historic District.

Navy installations in Maine. A fourth ICRMP is also under development for NSA Prospect Harbor. These ICRMPs outline management for 246 historic buildings, five historic districts, 12 contributing landscape features and 26 known archaeological sites.

Naval Air Weapons Station China Lake Cultural Resource Team, California

Located in the Mojave Desert and spanning 1.2 million acres, Naval Air Weapons Station (NAWS) China Lake represents 34 percent of the Navy's land holdings worldwide.



April Halpin stands beside anthropomorphic figures located within Coso Petroglyph National Historic Landmark onboard NAWS China Lake. The largest figure stands over five feet tall.

Mike Baskerville

At least 95 percent of this land been left undisturbed, and it is home to the largest collections and concentrations of Native American rock art in the Western Hemisphere. During the awards period, the cultural resources team inventoried over 57,901 acres (nearly five percent of total land area). Most notable was a demonstration project that recorded 200 meters of Little Petroglyph Canyon. The project demonstrated that with modern technology such as photogeometry, GPS base stations and drones, such sites can be recorded in months instead of years.

Environmental Planning

The purpose of this award is to recognize outstanding environmental planning for the Navy.

Ice Exercise (ICEX) 2016 Environmental Planning Team, Norfolk, Virginia

The Navy's Ice Exercise (ICEX) is a biennial exercise conducted above the Arctic Circle in cooperation with other branches of the military, government agencies, academic institutions and others. ICEX provides submarines the opportunity to train in an operationally demanding environment. Coordinating this event in such an environmentally sensitive area requires a diverse group of talents, and the environmental planning team rose to the challenge in 2016, successfully integrating operational and environmental planning processes. This year, new and more environmentally sustainable materials, designs and processes were researched and evaluated, resulting in a reduced environmental footprint and a finding of No Significant Harm

from the U.S. Fleet Forces Command. The significant achievements of this team will lead the way for future success in this important frontier for the Navy.

Mariana Islands Training and Testing Environmental Impact Statement Team, Pearl Harbor, Hawaii

The Navy's ability to train and test in the Mariana Islands Range Complex (MIRC) relied on existing authorizations issued under the Marine Mammal Protection Act and Endangered Species Act (ESA), which were due to expire in 2015. To ensure that operations could continue uninterrupted, the Mariana Islands Training and Testing Environmental Impact Statement team was formed. This multi-service and multi-organizational team faced a task that was challenging due to the geographic scope and ecological diversity of the study area and the complex historical, political and cultural relationships involved. The team proved to be adept at responding to emergent issues, such as incorporating newly listed ESA species, addressing public concerns (e.g., fishing access) and reducing public and local governmental confusion over multiple ongoing major DoD National Environmental Policy Act efforts in the Marianas. Through strong and dedicated leadership and cooperation among the diverse team, the EIS was completed with all permits and authorizations received on time.

Ice Camp Sargo hosted more than 200 participants from four nations and tested a variety of shelter, flooring and heating options with an eye towards reducing the environmental impact of future ICEXs.

MC2 Tyler Thompson



The MIRC includes at-sea ranges, operating areas, special use airspace and land-based training areas on Guam (shown) and the Commonwealth of the Northern Mariana Islands.

MCS Joan E. Jennings

Transit Protection System Port Angeles Environmental Assessment Project Team, Bremerton, Washington

A multi-disciplinary team of experts was assembled to complete an environmental assessment for the construction of a staging location for Transit Protection System vessels and crews that escort Navy submarines from Naval Base Kitsap Bangor to and from their dive/surface locations. The team's first challenge was addressing the public's concern about perceived increasing Navy presence in the Pacific Northwest, as well as the loss of an aquaculture facility and a recreational diving location. Early on, the team conducted outreach in the Port Angeles community to engage with these stakeholders in meaningful discussion throughout the planning process. This public and tribal engagement led to the development of a new alternative, which later became the alternative chosen in the Finding of No Significant Impact document, which was signed on schedule in August 2016.



Mitigation for construction of the Transit Protection System pier and support facilities will include restoration of portions of the adjacent Ediz Hook shoreline to natural conditions. The mitigation will also include the removal of this derelict structure being undermined by frequent storm surges.

Afloat

This category includes five competitive sub-categories; however, no entries were received in the Littoral or Amphibious Warfare category.

Surface Combatant: USS Monterey (CG 61)

USS Monterey is a guided missile cruiser, homeported in Norfolk, Virginia with 341 enlisted men and 48 officers onboard. During the awards period, Monterey undertook many measures to ensure complete compliance with all environmental regulations. Some of CG 61's accomplishments include the onloading of four million gallons of fuel without a spill, a complete overhaul of the ship's oily waste system to ensure the environmentally friendly storage and conditioning of oily waste and the use of fuel burn graphs to inform engineers of optimal speeds for saving fuel. Perhaps most important is the emphasis on effective and repeated training for all crew in energy efficiency and waste management practices.



Petty Officer 3rd Class Kevin Foy performs preventative maintenance on the gas turbine engine aboard USS Monterey. Engineers take great care to minimize exhaust through the effective use of pre-filters, coalescers and purifiers.

Petty Officer 2nd Class William Jenkins

Large Deck Combatant: USS Harry Truman (CVN 75)

Harry S. Truman is an aircraft carrier homeported in Norfolk, Virginia. Truman's crew total 3,032 with an additional 1,969 personnel embarked from CSG-8, Carrier Air Wing Seven, and Destroyer Squadron Two Eight. Truman had many notable accomplishments during the awards period including the upgrade of 80 percent of the ship's plastic waste processors. These



An MH-60S Sea Hawk helicopter performs a replenishment-at-sea with USS Harry S. Truman. The ship had zero environmental spills during the reporting period.

MCS3 Anthony Flynn

processors melt plastic waste products for proper disposal. The crew also excelled at the safe handling of hazardous waste, in particular isocyanate-containing polyurethane paints for aircraft. With 69 aircraft on board, approximately 750 evolutions using this hazardous paint were conducted over the course of deployment with no incident to personnel or the environment.

reduce overall fossil fuel consumption. All plastics are retained onboard and taken to a recycling facility when ashore. All oily waste is also stored until it can be properly transferred to an off-hull collection facility when in port. Finally, every effort is made to procure environmentally sustainable products onboard, including laundry detergents and cleaning chemicals.



USS Virginia returns to homeport after completing a 14-week surge deployment.

MCS1 Jason J. Perry

Submarine: USS Virginia (SSN 774)

USS Virginia is tasked with anti-submarine warfare. Currently homeported in Groton, Connecticut, USS Virginia has a crew of 148. Energy conservation is deeply embedded in ship operations, driven from the command leadership and enforced by the entire crew. Upon entering to port, all unnecessary electrical loads are secured and lighting is reduced to the minimum necessary to sustain a safe operational environment. Diesel generator operations are limited to minimum essential requirements to

Military Sealift Command: USS Emory S. Land (AS 39)

USS Emory S. Land (ESL) is a submarine tender with a hybrid crew of 751 Sailors and civilian mariners. Homeported in Guam, ESL completed maintenance work on 15 submarines and 17 surface ships in FY 2016. Because of its workload, ESL generates a large amount of waste oil—a total of 150,000 gallons during this period. This oil is processed by an oily waste separator, set at 15 parts per million, which,

More Insights Into Naval Base Coronado's Win

PART OF NBC'S recycling success can be attributed to its participation in a food waste study undertaken by NAVFAC Engineering and Expeditionary Warfare Center (EXWC) engineers. This study was funded by the Navy Environmental Sustainability Development to Integration (NESDI) program.

The eight-month study reviewed the common practices being used for separating food wastes from the solid waste stream at NBC and nearby NAS North Island. The goals were to identify current practices and to devise ways to meet the DoD goals of diverting at least 50 percent of non-hazardous solid waste from landfills by the end of FY 2015.

At NBC, the experience allowed the galleys to reduce waste being generated and further streamline their process for food preparation. By separating their food waste, weighing each container and logging the weights prior to disposal in outdoor containers, workers could better visualize the waste being generated. NBC began composting food waste in January 2016, after training from the City of

San Diego. At the beginning of the NESDI-sponsored study, the NBC galley was composting over 10 tons a month. Now, due to waste reduction techniques, they are composting less than 7 tons a month. In addition, the compost is being offered to residents of San Diego for use as topsoil. The reduction in food waste saved the NBC galleys \$40,000 in FY 2016.

The information gathered from this study is being used to develop and implement food waste composting throughout the Navy. At the beginning of this project, only about 15 percent of Navy installations that generate one or more tons of solid waste per day were composting materials, usually green waste. Only two or three of these installations were incorporating food waste in the compost operation. With the development of an updated guidance document, NAVFAC EXWC expects that at least half of these installations will begin to incorporate food diversion.

The NESDI program's mission is to demonstrate, validate and integrate innovative technologies, processes and materials and fill knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness.



Food waste.
Jill Hamilton

For more information about the NESDI program and this project, visit <https://epl.navfac.navy.mil/nesdi> and search for project 478. (A Common Access Card is required for access.)



ESL provides maintenance, hotel services and logistical support to submarines and surface ships in the U.S. 5th and 7th Fleet areas of operations.

MCS3 Daniel Willoughby

along with close supervision from the chief engineer, resulted in zero spills during this period. Among other accomplishments, the Radiological Controls division conducted numerous transfers of radioactive material without incident. Solid waste management is state of the art, with onboard paper pulpers, glass and metal shredders and plastic waste compressors that process waste onboard.

For more information about the CNO Environmental Awards program, visit <http://greenfleet.dodlive.mil/environment/awards>. ⚓

Madeleine Joyce
Chief of Naval Operations Energy and Environmental Readiness Division
703-695-5073
DSN: 225-5073
madeline.joyce.ctr@navy.mil



Energy Warrior is now available on

Instagram

Follow us **@energy.warrior** for a new perspective, a fresh approach, and recognition for every kind of hero.

What is Energy Warrior?

Energy is critical to the Navy's mission—it is our greatest enabler and our greatest vulnerability. We know that energy efficiency gives an obvious advantage to our military and our nation, but achieving our energy goals is no easy task. That's why we're calling on our team of naval innovators across the globe to share their ideas, creative solutions, and personal experiences regarding some of the most challenging issues facing our Navy today. Our goal as the Energy Warrior team is to share and promote all ideas, to give everyone a voice.

With the new Energy Warrior Instagram account, we hope to expand our audience with captivating visuals and a totally new platform for collaboration. From stunning photos of ships refueling at sea to personal portraits of our most dedicated Sailors, Energy Warrior will give you an inside look at what's really happening throughout the fleet when it comes to all things related to energy and innovation. The Energy Warrior team wants to put energy at the forefront of all our decisions, both in combat and everyday life.

The Energy Warrior team wants to put energy at the forefront of all our decisions, both in combat and everyday life.



HOW TO SUPPORT ENERGY WARRIOR:

1

If you use Instagram on your smartphone or tablet, you can find us **@energy.warrior**. Are you on desktop? No problem! Find us at www.instagram.com/energy.warrior.

2

Want to see the videos that bring our community to life? Find us on YouTube at **EnergyWarriorTV** for exclusive interviews, inspirational pieces, a closer look at cutting-edge technology, and so much more.

3

Download the **Energy Warrior App** to stay on top of what's happening in the energy world. Get it for free now from the App Store or Google Play, then let us know what you think!

We are a team of **warfighters, Sailors, scientists, and engineers.**

But, first and foremost, we're a team of innovators, with the goal to secure our energy future and become a stronger and more resilient fighting force. Join our team and show your support for the Navy's energy initiatives. "Like" and comment on our photos, follow us for immediate updates, and tell your friends to do the same! It's time to **#DisruptTheFuture**.





ENERGY WARRIOR PROFILE

PATRICK RUSSELL

HOMETOWN: San Diego, CA



INSTALLATION ENGINEER
NAVAL FACILITIES ENGINEERING
COMMAND SOUTHWEST

“If you can appreciate the importance of energy use and conservation, then you’ll be more inclined to be a better energy steward for the Navy. You start to slowly change the way you think, especially if you live or work on a base.”

Q: HOW MANY DIFFERENT INSTALLATIONS DO YOU WORK WITH AND WHAT ARE SOME OF YOUR PROJECTS?

I support Camp Morena, Navy Auxiliary Landing Field (NALF) San Clemente Island, NALF Imperial Beach, the Silver Strand Training Complex South, Naval Amphibious Base and Naval Air Station North Island. I also work with personnel from Camp Michael Monsoor and the Remote Training Site Warner Springs, which are east of San Diego—out in the forest.

We are doing about five Rasterization and Modernization energy (RMe) projects right now, and they range from lighting to water savings to heating, ventilation and air conditioning system upgrades and retro commissioning (the application of the commissioning process to existing buildings). Combined, that’s about two or three million dollars’ worth of projects.



ENERGY EFFICIENCY INCREASES

Q: HOW DID YOU FIRST BECOME INTERESTED IN WORKING WITH ENERGY?

My first job as an energy program manager was at Andersen Air Force Base. That's really where I got a feel for everything that was going on. I was like, "I could do this as a career. This is fun." It's a dynamic job—there's something new going on every day. It's a two part job—there's a project portion and a program portion. So I am never bored.

Q: WHY IS CULTURE CHANGE WITHIN THE NAVY REGARDING ENERGY SO IMPORTANT?

Well, say you're a brand new Sailor or Soldier coming into the military. I mean, I was there. (I was in the Army). I had no clue about how the military really operated or how much energy we consumed. Now, I have a much greater understanding of how it all works. And if you can appreciate the importance of energy use and conservation, then you'll be more inclined to be a better energy steward for the Navy. You start to slowly change the way you think, especially if you live or work on a base.

Think about the impact that energy has on your everyday life—anywhere from using your phone to turning on a light. It's a convenience, right? One of the best things in the morning is letting that hot water hit you in the shower. But, if you think about what it really takes to get that hot water to you—the logistics that go into making that happen—then you start to understand just how dependent we are on energy that is readily available to us.

It comes down to the small, cumulative savings. Once everybody starts playing their part and doing their thing to save energy, that's when culture change really happens.

Q: HOW DO YOU THINK WE CAN COMMUNICATE THIS CRUCIAL MESSAGE TO OUR SAILORS?

If you focus on the young man or woman coming into the military and instilled them with Navy values—part of that being energy conservation—then they'll take those lessons with them for the rest of their career. If you plant the seed early, it's going to grow throughout their professional and personal lives.

But the culture is different on every base. I have lots of experience working at different bases and people are different at every base. So, you have to tailor your message to your audience and where they're located. You have to change your approach depending on the culture at hand.

Q: WHAT DOES BEING AN ENERGY WARRIOR MEAN TO YOU?

Anyone who wants to be an Energy Warrior can be one. Ultimately, Energy Program Managers can act as mentors since we are usually on the technical forefront of energy conservation initiatives and methods across the Navy. So we're teaching people what we know and that's cool. Knowledge is one of the greatest gifts you can give somebody. It's a delivery system of information that's ultimately going to help everybody. That's what it means to me to be an Energy Warrior.



NAVY Earth Day 2017

**BUILDING STRENGTH
THROUGH STEWARDSHIP**





NAVFAC EXWC Tests Feasibility of Smart Water Conservation System

System May Significantly Reduce Potable Water Consumption

A RECENT DEMONSTRATION project by engineers from the Naval Facilities Engineering Command (NAVFAC) Engineering and Expeditionary Warfare Center (EXWC) investigated the use of a smart water conservation system for landscape irrigation.

In some regions of the United States, such as the Southwest, water use is highly regulated due to drought conditions, and implementation of water-saving systems has become a necessity. In addition, Executive Order 13693, Planning for Federal Sustainability in the Next Decade, requires the federal government to reduce potable water usage 36 percent by 2025.

Smart water conservation systems offer a way to meet these challenges by reducing potable water use while maintaining a reasonable amount of green space and landscaping on Department of Defense (DoD) properties.

In an effort to quantify the pros and cons of a smart water conservation system, the DoD's Environmental Security Technology Certification Program (ESTCP) sponsored the installation of a system at Naval Base Ventura County (NBVC) Port Hueneme, California in collaboration with the Navy Environmental Sustainability Development to Integration (NESDI) program and the U.S. Army Corps of Engineers Construction Engineering Research Laboratory.

The demonstration was conducted by NAVFAC EXWC engineers who specialize in environmental and energy projects, including water conservation.

The Demonstration Site

The system was installed in early 2013 at NBVC Port Hueneme's Building 1100, which provides office space for over 500 engineers, scientists and support staff.

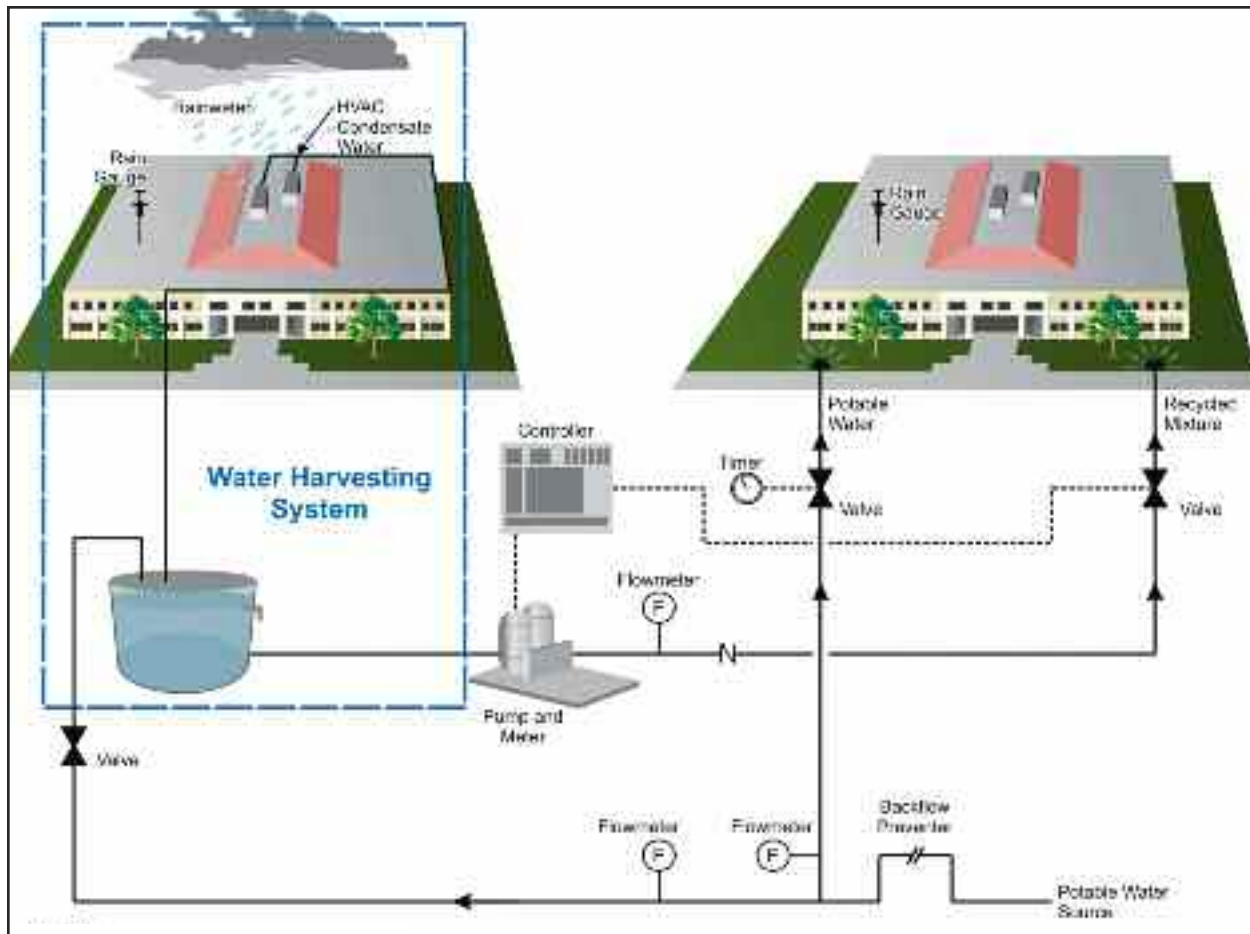
The demonstration area included a "smart plot" along with a control plot to demonstrate the new system alongside the current, more traditional irrigation system. Both the smart and control plot have a turf area as well as an area of myoporum (a native ground cover) covering 6,500 square feet. These plots are roughly equivalent in size and location.

About the System

The smart water conservation system includes an integrated suite of commercially available technologies for irrigating landscape:

- Evapotranspiration (ET) irrigation controller
- Centralized and site-specific sensor inputs (ET, rain, soil moisture and leak detection)

Smart water conservation systems offer a way to reduce potable water use while maintaining a reasonable amount of green space and landscaping.



Schematic of the smart water conservation system and a traditional irrigation system.

- Efficient sprinkler distribution systems
- Water harvesting of rain and air conditioning condensate

Rainwater & Heating Ventilation & Air Conditioning Condensate Water Harvesting System

The water harvesting subsystem is comprised of commercially available plumbing and an underground storage tank (UST) constructed on the west side of Building 1100. Heating ventilation and air conditioning (HVAC) condensate and rainwater from the building's rooftop is diverted to the 17,000-gallon underground tank and subsequently pumped to irrigate the smart plot.

For a large facility, such as Building 1100, an HVAC system can potentially generate 0.4 to 5.3 gallons per hour of condensate water, depending on the cooling load placed on the chillers (approximately 25,000 gallons annually).

Three downspouts from the western half of the building's rooftop were rerouted to the 17,000-gallon harvest tank. The location served by these three downspouts covers an area of 29,400 square feet. Rainwater discharging through these downspouts during an average year (12 inches of rain per year) could produce over 200,000 gallons of rainwater—well over the required amount needed for the smart plot. If funding

is available, a larger tank could be installed downstream of this system to take advantage of this water source instead of letting it overflow to the storm sewer system.

The UST was constructed with modular polyethylene cells assembled together with an overall dimension of 14 by 40 by four feet (2,240 cubic feet). The nested cells were enclosed with a 36-millimeter thick polypropylene liner to hold water. Two manholes were installed on the top of the tank to allow installation of a submersible pump, float switches and ancillary piping. Holes were installed on one side wall to accommodate ports for the inlet harvested water, outlet pressure irrigation piping and



Construction and installation of a 17,000-gallon UST for the storage of harvested water.

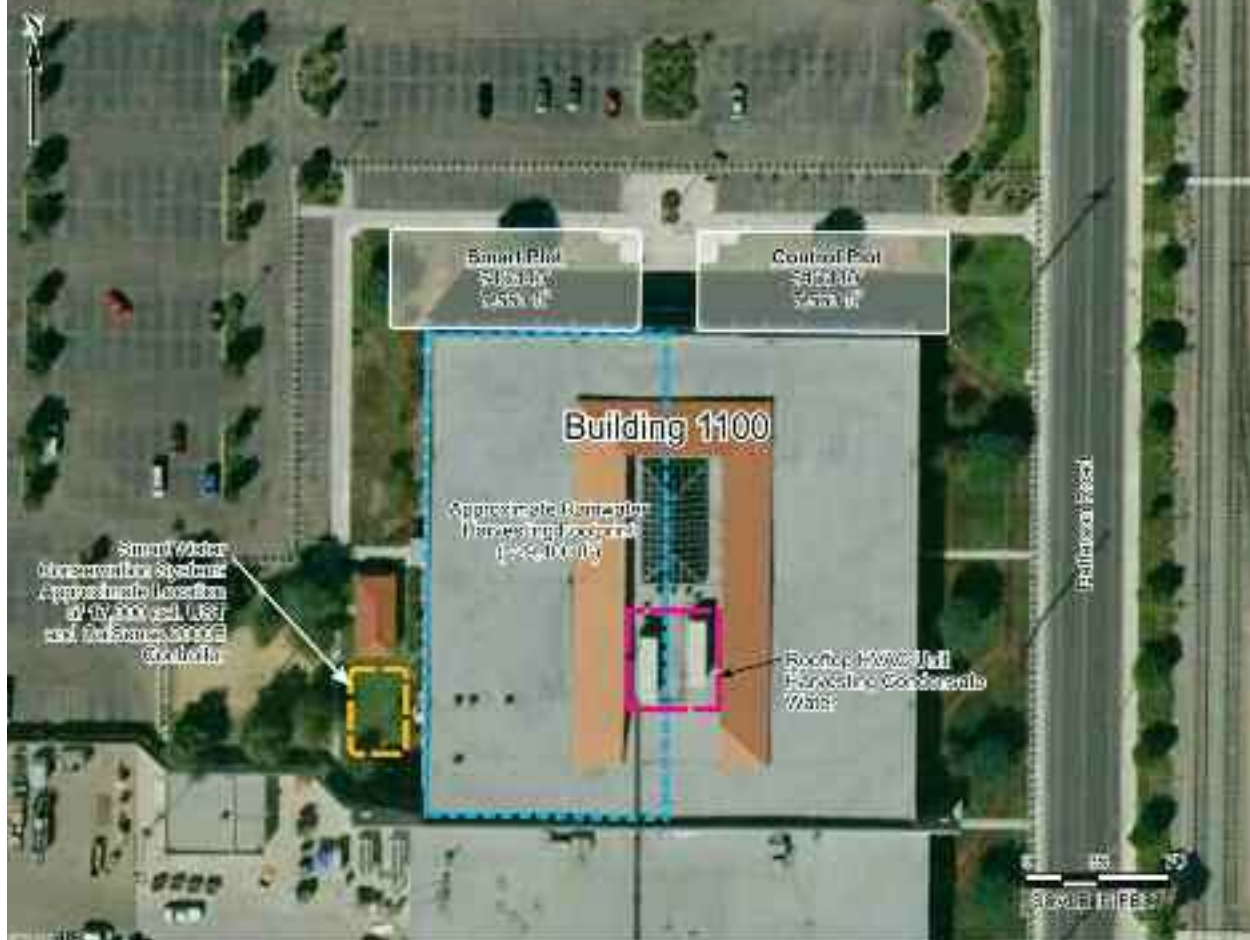
Gary Anguiano

electrical conduit. The UST was covered with a two-foot cap of native soil and sand which can support a vehicle of 16,000 pounds without adverse impact to the UST.

A one-horsepower, 110-volt submersible pump was installed at the bottom of the UST to irrigate the smart plot with harvested water. The pump was protected from running dry with the use of two low level float switches. These switches enable the pump to automatically shut down when water levels are too low for operation.

If rainwater collected from the rooftop and condensate water from the HVAC system were of insufficient volume to keep the pump primed or irrigate the smart plot, then potable water was obtained. When activated by the second float switch in the UST and directed by the ET controller, the flow control valve opened, allowing potable water to flow into the UST. The makeup water level within the UST was set at a minimum to allow harvested water to replenish the supply to the maximum extent possible.

The rain water harvest system included first flush diverters that redirect the first part of a rain event—which contains the greatest concentration of pollutants and debris—away from the harvest tank into the storm sewer. This lessens the possibility of contaminants clogging the sprinklers, flow meters or other components. Two first flush diverters types were used; a commercial-off-the-shelf (COTS) system and a Navy-built system made of standard plumbing hardware. The Navy system used a volumetric approach for first



Demonstration area immediately north of Building 1100 depicting the smart plot, control plot, approximate rainwater harvesting area and the underground water storage tank.

Google Maps

Operators are able to program the system to operate/irrigate based on site- and area-specific conditions.

flush diversion, whereby when 100 gallons of water was captured the following rainwater is diverted to the harvest tank. After the storm event, the diverted 100-gallon volume slowly drains from the diverter over the next 72 hours via a weep hole connected to the storm sewer. The COTS diverter used a flow based approach and is designed to reset itself after the rain event. In addition to the first flush diverters, a floating filter screen was installed inside the tank prior to the pump to prevent debris from entering the underground sprinkler system.

Advanced ET Controller

The main user interface for the smart water conservation system is a programmable logic controller. Through the use of the ET controller, operators are able to program the system to operate/irrigate based on site- and area-specific conditions. Basic functionality of the smart irrigation modular controller includes the following:

- Control over eight irrigation systems (upgradeable up to 32 irrigation zones)
- Four separate programmable settings to input different start times, system timing duration and watering days
- Self-diagnostic feedback to identify any operational issues
- Remote features, such as manual operation, program adjustment, as well as dial and switch settings accessible via personal computer, radio signal or cellular network

The controller interfaces with various sensors to efficiently irrigate the smart plot, including: ET gauge to calculate the irrigation run time correlated to existing weather conditions; a soil moisture sensor that terminates irrigation if actual soil moisture meets the programmed set-point; and a rain gauge that terminates irrigation upon a rain event.



Control plot and smart plot at Building 1100.

Gary Anguiano

Water-efficient Sprinkler, Flow Meters & Pressure Regulating Device

Efficient irrigation hardware, including pipeline design, multiple high-efficiency sprinkler nozzles, pressure-regulating valves and a flow meter were also part of the smart water conservation system. The sprinkler nozzles were designed to provide even water distribution within a

10-foot radius. The regulating valve device minimizes water loss caused by excessive pressure to the sprinkler nozzle, which can cause overspray.

A flow meter was installed in the irrigation pipeline as a subsystem of the ET controller. The controller can be programmed to alert facility operators when the flow rate is above a specified value. High flow rates occur as a result of



CLOCKWISE FROM LEFT:
Smart irrigation modular
controller, ET gauge,
uncovered ET gauge,
rain gauge.

Gary Anguiano





Constant volume first flush diverters installed at the base of Building 1100.

Gary Anguiano

a breach in the pipeline or a broken sprinkler nozzle. If sprinkler nozzles are accidentally broken by lawn equipment or maintenance crews, then the flow rates exceed normal flow patterns and the problem may not be discovered for many days. The controller can detect these changes in flow rate and shut down the irrigation system or provide an email alert to operators.

In addition to tracking potential leaks in the system, the flow meters also tracked the volume of both harvested and potable irrigation water used during the demonstration period. Data were collected monthly and totaled at the end of the two years to assess overall and individual performance of the system.

Performance Assessment

Specific success metrics were established to compare potable water use, energy use, operating cost, economic payback, irrigation effectiveness and qualitative turf health (appearance) for the smart and control plots.

The smart water conservation system at NBVC met primary water reduction goals and all of the additional performance objectives with the exception of economic payback. In short, the system produced the following results:

- Overall, there was an 81 percent reduction in potable water use when comparing the smart and baseline plots.
- Overall energy usage was reduced by 57.4 percent.
- The ET controller's contribution towards water reduction was 55 percent.
- All smart water conservation system components achieved 100 percent operational availability during the monitoring phase.
- The calculated economic pay back for a new ET controller installation (without condensate and rainwater harvesting) was 5.2 years.
- The performance objective for economic payback set at 25 years was not achieved.

Not only does the smart water conservation system use less potable water, it also utilizes the water much more efficiently.

The Basics About ESTCP & the NESDI Program

ESTCP

ESTCP is DoD's environmental technology demonstration and validation program. Project researchers conduct formal demonstrations at DoD facilities and sites in operational settings to document and validate improved performance and cost savings. Demonstration results are subject to rigorous technical reviews to ensure that the conclusions are accurate and well supported by data.

For more information, visit www.serdp-estcp.org.

The NESDI Program

The NESDI program seeks to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The NESDI program is the Navy's environmental shoreside (6.4) Research, Development, Test and Evaluation program. The program is sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Command out of NAVFAC EXWC in Port Hueneme, California. The NESDI program is the Navy's complement to ESTCP.

For more information, visit <https://epl.navfac.navy.mil/nesdi>. (A Common Access Card is required for access.)



For More Information

FOR MORE INFORMATION on the smart water conservation system, visit the ESTCP website at <https://www.serdp-estcp.org/index.php/Program-Areas/Energy-and-Water/Water-Conservation/EW-201019/EW-201019>. A final report is also available for download by clicking on the "Final Report (posted 10/16)" hyperlink under the "Products" heading on the "Smart Water Conservation Systems for Irrigated Landscapes" webpage.



Economic Feasibility

Economic payback and water reduction potential is determined on a case by case basis based on site-specific factors including local water cost, irrigation demand, roof size and water harvesting tank size. For example, if HVAC systems are not installed on rooftops, then a gravity-fed distribution system is not possible, necessitating the addition of pumps at additional cost. If air conditioning (A/C) units are decentralized, this also raises costs. And HVAC units that chill outside air will provide more condensate water than those units that intake re-circulated indoor air.

The smart water conservation system retrofitting at NBVC did not meet the economic payback period due to the high cost of the water harvest tank, relatively low cost of potable water at NBVC and the relatively small size of the smart turf plot. However, as the amount of irrigated landscape is increased, and/or the cost of water increases, the payback period will trend to a more favorable figure due to the substantial water reduction provided by the ET controller.



A high-efficiency volume sprinkler nozzle and flow meter.

Gary Anguiano

New development projects greater than 5,000 square feet are now required to implement “green infrastructure” or “low impact development” technologies to manage on-site stormwater runoff. Engineers should consider implementation of water harvesting as a means to manage stormwater to meet this requirement and couple it with an ET irrigation controller and efficient sprinkler hardware.

For substantive turf or landscape area retrofits, implementation of the sensors and ET controller makes the most economic sense since payback can be achieved in less than six years—particularly in sport fields in arid climates.

The ideal geographic areas in the southwestern United States to implement a smart water conservation system are locations such as Tucson, Arizona and Fort Hood, Texas, which receive monsoonal rains that replenish the water harvest tank during the summer months when demand is greatest. In addition, facilities in these locations are also known to generate large amounts of A/C condensate.

Areas that have high local water costs or limited water supply options may also benefit from water harvest.

If a location meets the requirements stated above, the smart water conservation system, or its subcomponents, are likely a cost-effective choice. Not only does the system use less potable water, it also utilizes the water much more efficiently, providing irrigation precisely when and where it’s needed most. The controller’s automatic warning function also greatly reduces water loss through leakage and saves manpower through remote control operation. [🔗](#)

Gary Anguiano
 Naval Facilities Engineering and Expeditionary Warfare Center
 805-982-1302
 DSN: 551-1302
gary.anguiano@navy.mil

NSWC Carderock & Department of Energy Host Wave Energy Competition

Aquaharmonics Claims \$1.5 Million Prize for Winning Prototype

THE DEPARTMENT OF Energy's (DOE) Office of Energy Efficiency and Renewable Energy announced Aqua-Harmonics as the first-place winner at the Wave Energy Prize Innovation Showcase held at Naval Surface Warfare Center (NSWC), Carderock Division in West Bethesda, MD on November 16, 2016.

Nine teams competed as finalists in the competition, which was hosted by the DOE and supported by both the Office of Naval Research and NSWC Carderock. The purpose of the contest was to test various wave energy conversion (WEC) prototypes and evaluate their effectiveness for harnessing energy from ocean waves, with the ultimate objective of identifying an effective model for future, larger scale wave energy devices. The

competition aimed to double the energy typically generated from ocean waves and identify a cost-effective solution for wave energy on par with conventional energy sources.

The ceremony to recognize the winners and runners-up was attended by Dr. Franklin Orr, Department of Energy Under Secretary for Science and Energy; Dennis McGinn, then-Assistant Secretary of the Navy (Energy, Installations & Environment); Joseph Bryan, then-Deputy Assistant Secretary of the Navy for Energy; Capt. Mark Vandroff, NSWC Carderock Commanding Officer; and David Masten, founder, chairman and chief technology officer of Masten Space Systems.

"If you look around, it doesn't take long to go to the beach and see,

'Wow, that's a lot of energy,'" said McGinn during remarks at the showcase. "So figuring out how we can harvest that energy in an inexpensive, reliable way makes so much sense. It will add to our energy portfolio ... having this added to it, along with wind and solar [power], just makes a lot of sense."

DOE's Marine and Hydrokinetic Technology Program Manager Alison LaBonte explained the inception of the competition. In recent years, DOE has routinely received wave energy proposals from various companies and institutions, but recognized that many newer and smaller organizations have a limited understanding of how to get their projects funded.

"What we didn't have was a mechanism for those players out there that may not have experience trying to receive government grants, or even where to apply for government grants that they could easily—with no hurdles of bureaucracy—bring these ideas to the table and have them evaluated," said LaBonte. "We wanted to attract those new players, create a level playing field for them all. We're still young enough in the technology development that we could discover

2016 Wave Energy Prize Winners

First Place	AquaHarmonics (Portland, OR)	\$1.5 million
Second Place	CalWave Power Technologies (Berkeley, CA)	\$500,000
Third Place	Waveswing America (Sacramento, CA)	\$250,000

something that's far out, while in position to succeed in our long-term goal of cost-competitive energy conversion in high energy/low cost market.”

Ninety-two teams originally registered for the competition in April 2015. During the 20-month duration of the competition, teams designed, built and tested their devices. The three-phase competition was divided into four distinct technology gates:

- Technology Gate 1: Technical submission; for determination of qualified teams (Prize Phase 1: Design)
- Technology Gate 2: Small scale (1/50th) model testing, numerical modeling for determination of finalists and alternates (Prize Phase 1: Design)
- Technology Gate 3: Verify the level of build progress and test readiness of identified finalists and alternates (Prize Phase 2: Build)
- Technology Gate 4: Testing of 1/20th scale model at the maneuvering and seakeeping (MASK) basin at NSWC Carderock; for determination of prize winners (Prize Phase 3: Test and Evaluation)

The field of competitors narrowed as each technology gate was reached. Sixty-six teams met the conditions to pass technology gate 1. Wave Energy Prize judges then selected



Then-Assistant Secretary of the Navy (Energy, Installations & Environment), Dennis McGinn gives opening remarks at NSWC Carderock's Wave Energy Prize Innovation Showcase.



AquaHarmonics displays their trophy and a scale model of their wave energy device at the Wave Energy Prize Innovation Showcase at NSWC Carderock on November 16, 2016.

Madeline Joyce

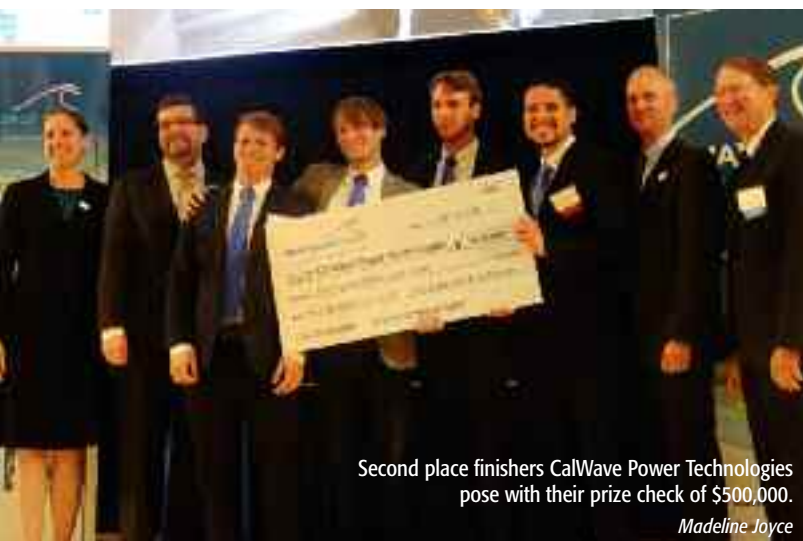


Alex Hagmuller and Max Levites-Ginsburg of Aquaharmonics pose with Alison LaBonte (far left) and other competition organizers to accept their first-place prize of \$1.5 million at NSWC Carderock's Wave Energy Prize Innovation Showcase.

Madeline Joyce

We were working out of a garage, we didn't have a lot of resources, [and] we didn't have great facilities... it was surprising to us what we were able to achieve.

—Max Levites-Ginsburg



Second place finishers CalWave Power Technologies pose with their prize check of \$500,000.

Madeline Joyce

20 teams to proceed to technology gate 2, which were further narrowed to nine finalists and two alternates that competed in technology gate 3. Technology gate 4 commenced in August 2016, where the nine selected finalists tested their 1/20th scale models.

NSWC Carderock served as an ideal venue for the competition due to the location of the MASK basin. The 12-million-gallon facility is the Navy's largest wave pool and is capable of mimicking various ocean conditions. Supporting wave energy testing also meets Carderock's congressional charter, which directs that the command sustain both Navy operations and requirements for the overall maritime industry.

"I already knew that Carderock had technical expertise that could be leveraged for wave energy technology device testing," said LaBonte. "They also bring to the table the human element of what it means to hold a high-profile competition on your grounds, and the value that provides for attracting a workforce to the science and engineering domain. Combined with a real appreciation of the energy security challenges facing the Navy, Carderock was uniquely qualified to bring all of this together in one place."



Third place finishers Waveswing America pose with their prize check of \$250,000.

Madeline Joyce

Staff at Carderock contributed to writing rules with the prize administration team and were instrumental during the testing phase of the competition. David Newborn, ocean engineer at Carderock's Maritime Systems Hydro-mechanics Branch, served as one of the five judges on the panel. He spoke of why this competition was advantageous to Navy operations. "A significant amount of our assets are shore based...so our facilities may be able to utilize some of that [wave] power." Researchers are also



The Innovation Showcase demonstrated AquaHarmonics' WEC device at NSWC Carderock's MASK basin.

Madeline Joyce

exploring the feasibility of leveraging this same technology on afloat platforms.

Remote island regions where it is costly to transport fuel would benefit from wave energy technology. "Typically in places that are surrounded by the ocean and that have a really good wave resource are places where it is very expensive to get fuel. So it becomes economically viable in regions where access to fuel is expensive such as Hawaii, Diego Garcia and Guam," said Newborn.

The two-person team of AquaHarmonics of Portland, OR is comprised of Alex Hagmuller and Max Levites-Ginsburg, civilian engineers and Oregon State University graduates. Hagmuller and Levites-Ginsburg's first wave energy model dates back to 2009 and spawned several more prototypes before they settled on their winning design. The simple design consists of a steel buoy, situated in a sealed ball attached to a motor anchored to the seafloor. Hagmuller explains its process, "On the upswell of the wave you're able to generate power and on the downfall of the wave, the generator actually acts as a motor and reels the line back in and gets ready for the next wave set."

Hagmuller believes the design model and capability makes it a viable device. "Any type of remote type operation that's in a maritime environment offshore...you name it, it can be integrated into that," he concluded.

"We were working out of a garage, we didn't have a lot of resources, [and] we didn't have great facilities ... it was surprising to us what we were able to achieve," Levites-Ginsburg stated at the Innovation Showcase.

What they achieved was a powerful device that quintupled the baseline energy production requirement previously established. AquaHarmonics demonstrated their

Department of the Navy's Exploration of Wave Energy

THE NAVY ESTABLISHED a Wave Energy Test Site (WETS) off the coast of Kaneohe, Hawaii as a test site in coordination with the Marine Corps, private sector developers, Department of Energy and the Hawaii Natural Energy Institute. The Azura WEC device located at WETS is generating electricity for the island of Oahu and Marine Corps Base Hawaii, capable of generating up to 18 kilowatts of electricity. The state of Hawaii's goal is to be powered 100 percent on renewable energy by 2045, and the WEC is one of the sources contributing to that objective. In July 2016, the Naval Facilities Engineering Command Engineering and Expeditionary Warfare Center hosted a blessing ceremony to commemorate the addition of deep-water berths at WETS that comprise the grid infrastructure along with shallow-water berths.



Alex Hagmuller, a mechanical engineer from the AquaHarmonics team, tells the crowd how their WEC device is working to absorb energy from waves, which can then be converted and used as a power source before the demonstration of the device.

Monica McCoy

winning device at the innovation showcase where the prototype extracted energy from the waves created in the MASK basin for the audience.

Second place finisher CalWavePower Technologies of Berkeley, CA, comprised of a four-person engineering team, submitted a submerged differential device into the competition. In third place, the three-person team of WaveSwing America of Sacramento, CA showcased their sub-sea pressure-differential point absorber wave power generators.

Ms. LaBonte highlighted the collaboration between the Navy and DOE. “We learned a lot from each other

through the course of the competition. Now we’ve basically spun off a list of what things could we collaborate on moving forward, now understanding what we know about each other’s challenges. So it’s been really valuable,” she said.

LaBonte believes wave energy has strong potential for making facilities more resilient.

“Could this technology be one that’s possible to install, operate and maintain for increasing our energy security at our bases, at our installations?” LaBonte posed. “I think we both have a better understanding that the answer is yes, and the timeline is still a little down the road. But feasible solutions have already been brought to the table.”

NSWC Carderock is a field activity of Naval Sea Systems Command and headquartered in West Bethesda, MD. Their mission is to provide research, development, test and evaluation, analysis, acquisition support, in-service engineering, logistics and integration of surface and undersea vehicles and associated systems. Comprised of approximately 3,200 scientists, engineers and support personnel, they are the Navy’s experts in maritime technology. 

NSWC Carderock’s Maneuvering and Seakeeping Basin

NSWC CARDEROCK’S MASK basin is the Navy’s largest indoor wave pool. The Navy constructed the wave pool in 1962 to evaluate the maneuverability of scale models of ships and other platforms under realistic sea conditions. With dimensions of 360-feet long by 240-feet wide, the pool holds approximately 12 million gallons of water. Carderock renovated the pool in 2013, installing 216 individually controlled electromechanical wave boards to simulate the ocean environment. The MASK basin can test ship models up to 30 feet in length to evaluate their performance and durability in harsh maritime environments.

Monica McCoy
Naval Surface Warfare Center, Carderock Division
301-227-1439
DSN: 287-1439
monica.mccoy@navy.mil

NESDI Program Releases FY16 Year in Review Report

Report Features Newly-Launched Initiatives

THE NAVY ENVIRONMENTAL Sustainability Development to Integration (NESDI) program has released its Year in Review report for fiscal year (FY) 2016 which underscores the program's commitment to integrating the technologies, enhanced industrial processes and other results of its projects into Navy operations.


The report contains a financial review of program expenditures as well as insights into projects that were particularly successful in demonstrating the use of an innovative technology or collecting critical information to enhance the efficiency of Navy environmental management programs. The report also features the following 15 initiatives as the program's FY16 "new start" projects:



1. Stable Carbon Isotopes for Tracing In Situ RDX Remediation (project no. 537)
2. Development of Advanced Primer and Superhydrophobic Topcoat for Corrosion Resistance and Leachate Impedance (project no. 538)
3. Forward Looking Infrared (FLIR) for Advanced Discharge Characterization (project no. 539)

4. Smart Electronic Tools for Navy Environmental Compliance Monitoring and Reporting (project no. 540)
5. Utility Vault Water Treatment (project no. 541)
6. Naval Air Systems Command Solutions for Engine Washing (project no. 542)
7. Preventative Management of Contaminated Silt (project no. 543)
8. Stable-Isotope Labeled Tracers, an Innovative Way to Validate Natural Attenuation of RDX in Groundwater (project no. 544)
9. In Situ Treatment of 1,4-Dioxane Using Enhanced Biodegradation (project no. 545)
10. National Pollutant Discharge Elimination System (NPDES) Copper Effluent Control System (project no. 546)
11. Demonstration of Improved Toxicity Methodology to Link Stormwater Discharges to Receiving Water Impacts at Navy Sites (project no. 547)
12. Sewer Gas Elimination Technology (project no. 548)
13. Demonstration of Optimized non-NMP (n-Methyl-2-pyrrolidone) Solvents for Immersion Chemical Depainting (project no. 549)
14. A Comprehensive Analysis and Strategy for Contaminated Sediment Management (project no. 550)
15. Impact of Sediment Resuspension by Propeller Wash and Shore Sediment Dynamics on Remediation Options (project no. 551)

The NESDI program is the Navy's environmental research and development demonstration and validation program, sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Command.

An electronic (pdf) version of all Year in Review reports can be downloaded from the program's website at <https://epl.navfac.navy.mil/nesdi>. (A Common Access Card is required for access.) For a hardcopy of the FY16 report, contact Lorraine Wass at 207-384-5249 or ljwass@outlook.com. 

Ken Kaempffe
Naval Facilities Engineering and Expeditionary Warfare Center
805-982-4893
DSN: 551-4893
ken.kaempffe@navy.mil

Register Now for 2017 SERDP & ESTCP Symposium

Program Includes Technical Sessions & Training Opportunities

FOLLOWING A FIVE-YEAR hiatus, the Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) Symposium is back.



The Symposium will be held November 28–30, 2017 at the Washington Hilton in Washington, D.C. and will highlight the programs' recent efforts to enhance mission capabilities, reduce costs in times of increasing fiscal constraints and improve environmental and energy performance.

An introductory plenary session will be followed by a comprehensive technical program consisting of concurrent technical sessions and short courses covering a variety of scientific and technical topics. Attendees will have numerous opportunities to tour more than 450 posters and exhibit booths and network with approximately 1,200 environmental professionals. Technical exchange networking receptions will be held both Tuesday and Wednesday evening in conjunction with the poster sessions.

Technical Sessions

Sixteen technical sessions will highlight research and innovative technologies that improve the Department of Defense's (DoD) environmental performance, reduce costs and enhance mission capabilities. The following are this year's topics:

- Advanced Species Management: Military Lands in the Regional Context
- Chlorinated Solvents: Challenges and Progress
- Contaminated Sediments: Management Options
- Cost-Effective, Cutting-Edge Building Efficiency Technologies: Lighting, HVAC and Controls
- Energetic Materials: Alternative Materials and Processes

- Energy Information and Cybersecurity: Key to Smart and Secure Installation Operation and Investment
- Hexavalent Chromium and Cadmium: Alternatives for Plating Processes
- Insensitive Munitions: Safe & Sustainable
- Marine Mammal Retrospective: Linking Behavioral Responses to Population-Level Effects
- Microgrids: Building a Flexible, Secure and Resilient Base for Today and Tomorrow
- Pacific and Arctic Environments: Unique Importance and Challenges
- Per- and Polyfluoroalkyl Substances (PFAS): Treatments to Replacements
- Sustainable Alternatives to Current Military Finishing Systems
- Underwater Unexploded Ordnance (UXO): Systems for Detection and Classification
- Underwater UXO: Burial and Mobility
- Vapor Intrusion: Pathways to Solutions

Short Courses

Short courses will offer unique training opportunities on emerging technologies and methods in environmental restoration and munitions response. Professional development hours will be offered for participation in short courses. Attendance for these short courses will be limited, and advanced registration for each short course is required. The following are this year's short course topics:

- Contaminant Flux and Fate in Fractured Bedrock
- Geophysics for Environmental Characterization and Monitoring at DoD Sites
- Transition of Corrosion-Resistant Electrocoat Application Process into the Military Aviation Community
- Transitioning New Tools to Practice, Environmental DNA Methods and Protocols
- PFASs at Military Sites
- Emerging Regulatory Trends: Potential Impacts of TSCA and REACH to the DoD Mission


- Development of Cold Spray Technology for Additive Manufacturing
- Scenario-Based Coastal Risk Management
- Training System for Reducing Costs of Remediation and Long-Term Management of Contaminated Sites
- International Dimensions: Overseas Environmental Topics
- Sustainability Analysis: Capturing Life Cycle Impacts and Costs in Defense Systems

About SERDP and ESTCP

SERDP is DoD's environmental science and technology program, executed in partnership with the Department of Energy and the U.S. Environmental Protection Agency. SERDP invests across a broad spectrum of basic and applied research and advanced development. ESTCP is DoD's environmental and installation energy technology

demonstration and validation program. The program's goal is to identify and demonstrate cost-effective technologies that address DoD's highest priority environmental and installation energy requirements. Both programs address DoD environmental and installation energy needs in the Energy and Water, Environmental Restoration, Munitions Response, Resource Conservation and Resiliency, and Weapons Systems and Platforms areas.

To register for the Symposium, visit www.symposium.serdp-estcp.org.

For additional information or to register for the Symposium, visit www.symposium.serdp-estcp.org. 

Jeffrey Houff
SERDP and ESTCP Support Office
703-610-2709
symposium@noblis.org

Everyone has a story to tell. Tell yours in *Currents*!

The deadline for our fall 2017 issue is July 21, 2017.

Have some good news about your energy or environmental program? *Currents* is the place to tell your story. *Currents*, the Navy's official energy and environmental magazine, has won first place in the Navy's Chief of Information (CHINFO) Merit awards competition three times. It is people like you and the stories you submit that make *Currents* the best magazine in the Navy.

If you have a story that you'd like to promote in our fall 2017 issue, submit your text and images by Friday, July 21, 2017. Any submissions received after this date will be considered for our winter 2017-18 issue.

You can get a copy of the *Currents* article template by sending an email to Bruce McCaffrey, our Managing Editor, at brucemccaffrey@sbcglobal.net. This template has proven to be a tremendous asset in helping us edit and track your article submissions. Bruce is also available at 773-376-6200 if you have any questions or would like to discuss your story ideas. And don't worry. If writing isn't one of your strengths, we'll handle all of the editing necessary to get your submission into publishable form.

As a reminder, your Public Affairs Officer must approve your article before we can consider it for inclusion in the magazine.

Don't forget to "like" us on Facebook at www.facebook.com/navycurrents. *Currents'* Facebook page helps expand the reach of the magazine and spread the news about all the great work you're doing as the Navy's energy and environmental guardians.

Currents Deadlines

Fall 2017 Issue: July 21, 2017
Winter 2017-18: October 20, 2017
Spring 2018: January 19, 2018
Summer 2018: April 20, 2018

You can also refer to your 2016-18 *Currents* calendar for reminders about these deadlines.

Coho Salmon Return to Restored Streambed Near Naval Base Kitsap Bremerton

Species Swim Above Restored Culvert for First Time in Decades

JUST THREE YEARS after the completion of a major culvert restoration project near Naval Base Kitsap Bremerton, Coho salmon have been spotted above the culvert—digging a nest to lay their eggs.

The migrating salmon were discovered by John Knowles, an Engineering Technician at Naval Base Kitsap Bremerton, Public Works Department. Knowles was the restoration project manager and continues to monitor the ‘naturalization’ of the culvert to ensure success of the restoration. These were the first salmon seen above the culvert.

Although cutthroat trout are frequent visitors, Knowles witnessed one pair of Coho digging a nest about 500 feet upstream of the culvert. Knowles said, “It is very rewarding to see that all of our hard work is actually resulting in the production of new

habitat and spawning grounds for an endangered species.”

Once restoration of the stream bed and culvert were completed, the environment took over and now the streambed continues to cut down through the silt and debris that had built up in the streambed over the past 70 years by the restriction of the old culvert. Just upstream of the furthest point of the stream remediation, the streambed has dropped about six feet from where it was in September 2013. The stream continues to change all of that along with signs of lowering all the way up to the highway.

Most of the “fish rock” that the Navy installed during the stream remediation has migrated downstream below the culvert and filled in the starved areas there caused by the dam of the old 48-inch culvert. There is still a log

jam about 600 feet above the culvert that is holding back a lot of good spawning gravel but it’s starting to release and will soon migrate down as well. The culvert itself is doing well. Originally the stream would change channels every few weeks but it has finally settled into a more regular channel that was carved out over the winter. The erosion on the ‘railroad north’ side of the culvert has the inner wall exposed over two feet below the concrete but it seems to be stabilized now.

In March 2013, a Federal court ruled that fish-blocking culverts owned by the State of Washington violated Tribal Treaty Rights and by April 2015 nearly 300 culverts in the local area had been inspected. Of the 69 culverts that cross the Navy’s right of way, 36 were found to have some level of fish blocking issue. All 36 culvert issues are identified and

It is very rewarding to see that all of our hard work is actually resulting in the production of new habitat and spawning grounds for an endangered species.

—John Knowles



TOP: Coho salmon held captive in the old culvert plunge pool unable to continue upstream.

BOTTOM: Coho salmon heading upstream into recently re-opened habitat above the culvert replacement.

John Knowles

conceptual design projects to repair or restore the culverts are now awaiting funding.

The Navy and Puget Sound & Pacific Rail inspect the rail lines several times each year and also perform specific damage inspection after significant storm events. All of the railroad culverts have been assigned scores based on Washington State Department of Fish & Wildlife (WDFW)

For More Information

THIS STORY FIRST appeared in the fall 2014 issue of *Currents* and focused on the replacement of a culvert that had become a barrier to fish passing through to reach nesting sites above the culvert. The culvert was located 70 feet below an active Navy rail line which couldn't be taken out of service during the 13-month project. Restoration of the culvert was completed in October 2013 when the raining season and fish migration began.

You can download this story and browse the entire magazine archives at the Department of Navy's Energy, Environment and Climate Change web site at <http://greenfleet.dodlive.mil/currents-magazine>.



criteria and all streams passing under the railroad have been categorized as fish bearing or non-fish bearing and perennial or seasonal. WDFW has also identified species of fish that are living in the stream or pass through in migration. They rated the available habitat that would be gained upstream, quantity and quality, if the blockage was removed and also noted blockages downstream that needed to be removed to allow passage up to the Navy culverts. ⚓

Leslie Yuenger
Naval Facilities Engineering Command Northwest
360-396-6387
DSN: 744-6387
leslie.yuenger@navy.mil

Jim Creek Old Growth Forest Protects Ancient Legacy

Navy Personnel & Others Set Aside Old Growth Habitat Where Many Species Now Thrive

PERSONNEL FROM NAVAL

Radio Station (NRS) Jim Creek in Arlington, Washington set aside old growth habitat where the marbled murrelet now flourishes.

Several hundred years before the first Viking explorers attempted to settle North America, a small seed was taking root in western Washington. Over the course of 1,400 years, that seed became a tree which now stands

more than 250 feet tall and 11 feet thick. A community of such rare ancient trees thrives within 275 acres of a carefully preserved old growth forest surrounding NRS Jim Creek. The woods and wild lands were forever set apart as a natural area, largely due to the proactive conservation efforts of the Navy in the Pacific Northwest.

The area provides quality habitat for many native creatures, one of which

is the marbled murrelet, a small Pacific seabird known as a fast flier with rapid wingbeats and short wings. These birds are federally listed as 'threatened' under the Endangered Species Act in Washington, Oregon and California. Marbled murrelets are known to fly up to 50 miles inland to lay eggs and rear young in the old growth forest of NRS Jim Creek. Thanks to the Navy's natural resource

Today, only foot traffic is allowed inside NRS Jim Creek old growth forest which hosts a complex of some of the best quality wetlands in western Washington.





While plant communities of old growth forests naturally change over time, the longevity of the NRS Jim Creek old growth stand is a testament to biodiversity.

stewardship, this old growth forest area is protected and continues to provide quality nesting habitat.

In 1992, the NRS Jim Creek old growth forest was about to fall to the chainsaws of the Scott Paper Company when the Navy purchased for three million dollars the timber rights to land the Navy had already owned. The purchase accounted for 30 percent of the Department of Defense's (DoD) Legacy Resource Management Program annual funding. At the time, it was the single largest natural resource conservation project ever funded in the DoD.

However, saving the old growth forest was a close call. Back in 1950, the Navy purchased 4,827 acres in the Cascade Mountains to build a radio transmitting station that provides communication support for the Pacific Fleet. The initial purchase did not include forest timber rights. Since the old growth forest area was situated in a narrow mountain valley with few nearby roads, much of this

area was skipped over from initial timber harvests from 1900 to 1950. Native species that continued to flourish there include Sitka spruce, Douglas fir, western red cedar and western hemlock.

In 1990, after Scott Paper had announced their plans to begin logging there, the DoD was still

working to obtain funding for the purpose of preserving the nation's natural and cultural heritage. Congress eventually passed legislation that provided necessary financial assistance, allowing the Navy to acquire the old growth forest by offering Scott Paper a second growth timber harvest of equal value in exchange.



Back in 1950, the Navy purchased 4,827 acres in the Cascade Mountains to build a radio transmitting station that provides communication support for the Pacific Fleet.



Creatures of all kinds congregate on the vast holdings of the U.S. military. The DoD manages and protects 400 threatened and endangered species on 25 million acres of land, across 420 military installations.

Today, only foot traffic is allowed inside this ancient forest of behemoths. This intact forest and complex of wetlands is some of the best quality in western Washington. The forest supports a healthy and vibrant understory of plants adapted to this unique environment that was once common in the Cascade foothills.

While plant communities of old growth forests naturally change over time, the longevity of the NRS Jim Creek old growth stand is a testament to biodiversity. Old growth stands containing a variety of plant and animal life are better able to maintain their valuable diverse habitat qualities after a natural forest disturbance much better than younger developing forests.

The Jim Creek installation's many undeveloped acres provide a sustainable environment for a diversity of fish and wildlife species such as deer, bobcat, black bear, the American pika (smaller, rodent-like relatives of rabbits) and the Salish sucker (a rare bottom-dwelling fish found in fresh water lakes). Connecting streams provide unobstructed habitat for migratory salmon. These natural resources are managed through the implementation and maintenance of an Integrated Natural Resources Management Plan (INRMP) developed by the Navy installation



The NRS Jim Creek old growth forest supports a healthy and vibrant understory of plants adapted to this unique environment that was once common in the Cascade foothills. Connecting streams provide unobstructed habitat for migratory salmon.

Robin Hicks

cooperatively with other natural resource agencies.

Naval Station (NS) Everett personnel manage the environmental stewardship plan for NRS Jim Creek and

For More Information

FOR MORE INFORMATION about Navy Region Northwest, call 360-396-1630 or visit www.homeportnorthwest.wordpress.com, www.cnic.navy.mil/regions/cnrnw.html, and/or www.facebook.com/CNRRNW.



other Navy-assigned areas of responsibility. Plan initiatives are modeled after the DoD's Legacy Resource Management Program and focused on protecting natural and cultural resources, while enabling military readiness. Through continuing collaboration with the Stillaguamish Tribe, the U.S. Fish and Wildlife Service (USFWS) and the Washington Department of Fish and Wildlife, the program strives to incorporate knowledge and talents from within and outside of the DoD. This cooperation is integral to develop and update the INRMP on a regular basis and achieve many beneficial stewardship objectives.

"This project is a shining example of the DoD's concern for our nation's natural ecosystems," said Thomas Dildine, Environmental Program Director at NS Everett. "This old growth forest is a highly-specialized ecosystem which provides habitat for many unique plants and animal species and preserves them for future generations."

Creatures of all kinds congregate on the vast holdings of the U.S. military. The DoD manages and protects 400 threatened and endangered species on 25 million acres of land, across 420 military installations. The Department now manages more species per acre than any other federal agency including the National Park Service, U.S. Forest Service and USFWS.

"The old growth forest at Jim Creek will remain a diverse ecological legacy and natural classroom for coming generations to cultivate knowledge from the past and grow forest habitat objectives for the future," said Navy Regional Forester, Terri Jones. "Its benefits are priceless." 🚢

Kristin Ching
Naval Station Everett
425-304-3202
DSN: 727-3202
kristin.ching@navy.mil

Phil Guerrero
Navy Region Northwest
360-396-4955
DSN: 744-4955
phillip.guerrero@navy.mil

SERDP & ESTCP Announce 2016 Projects of the Year

Notable Efforts Include Research on Management of Munition Constituent Contamination

THE STRATEGIC ENVIRONMENTAL Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP) have selected nine “Projects of the Year” in recognition of outstanding research and technology developments that will benefit the Department of Defense (DoD). These efforts are helping DoD enhance its mission capabilities, improve its environmental performance and reduce costs. The following are recipients of this honor and descriptions of their award-winning projects. Additional information is available at www.serdp-estcp.org.

Energy and Water ESTCP Project of the Year

Zinc Bromide Flow Battery Installation for Islanding and Backup Power

*Mr. Ryan Faries
Raytheon*

DoD is the largest single consumer of energy in the United States. It operates over 500,000 buildings and structures with diverse inventory encompassing barracks, commissaries, data centers, office buildings, laboratories and aircraft maintenance facilities. A majority of these bases are largely dependent on a commercial power grid that is vulnerable to disruption from cyber-attacks, aging infrastructure, weather-related events and direct attack.

Mr. Ryan Faries from Raytheon along with his team demonstrated that microgrids with low cost, large-scale energy storage systems (ESS) have the potential to enhance energy



security on military installations. This was done by facilitating integration of more renewable energy and reducing single-point-of-failure vulnerabilities associated with tradition electric service and back-up generators. This project was conducted at Marine Corps Air Station (MCAS) Miramar.

The project involved integrating the advanced Zinc-Bromide Battery and Intelligent Power and Energy Management microgrid control technologies with the infrastructure at MCAS Miramar to provide energy security, islanding capability and reduced costs. The demonstration connected MCAS Miramar’s Department of Public Works (DPW) building to the ESS and solar photovoltaic (PV) system, enabling the building to receive power while disconnected (or “islanded”) from the grid.

The goal of the project was to peak shave and island the building circuit for 72 hours under controlled loads. The islanding duration was directly related to three main factors:

1. Battery energy capacity
2. PV system generation (solar resource)
3. Load reduction.

For demonstrating the islanding capability, the project simulated commercial power grid interruption and powered the building by PV and storage. The monitoring and control system controlled the ESS and collected the power usage data.

Data were then analyzed to determine if building loads were met during operational day scenarios.

The project successfully demonstrated the microgrid controller's ability to integrate and control the ESS, PV system and facility loads while connected to and islanded from the grid. The technology was able to manually increase and decrease the building load by more than 50 percent during islanding and the ESS was able to store energy during off peak time and discharge about 100 kilowatts of energy during peak time for close to three hours. While the demonstration did not meet the success criteria for the islanding duration, the system was able to power the DPW building from the PV array and ESS alone for over five hours and at its peak output, the PV array provided over 75 percent of the power to the facility.

Environmental Restoration ESTCP Project of the Year

Passive Biobarrier for Treating Co-Mingled Perchlorate and RDX in Groundwater at an Active Range

*Dr. Paul B. Hatzinger
CB&I Federal Services*

Perchlorate, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) are common and often co-mingled contaminants in soils and groundwater at military ranges worldwide. While in situ biodegradation of RDX, HMX and perchlorate individually have been demonstrated, remediation of co-mingled plumes has not been reported.



The Raytheon team demonstrated that microgrids with low cost, large-scale ESS have the potential to enhance energy security on military installations.

Dr. Paul Hatzinger from CB&I and his team led an ESTCP-funded project that aimed to investigate the feasibility of using a passive emulsified oil biobarrier to remediate co-mingled perchlorate, RDX and HMX at a contaminated site while minimizing impact to ongoing range activities.

The study results suggest that an emulsified oil biobarrier is a viable alternative to reduce the migration of co-mingled perchlorate and explosives in groundwater at sites similar to the trial site at the Naval Surface Warfare Center in Dahlgren, Virginia. Optimal areas for application of this technology include open burn/open detonation sites, munitions test ranges, explosive ordnance disposal training areas, target areas, munitions disposal sites and other regions where high concentrations of munitions constituents are likely to occur.

This remediation technology proves to be a passive and sustainable method with no requirements for operation or



An emulsified oil biobarrier has been demonstrated as a viable remediation technology for co-mingled munition constituent contamination.

maintenance other than injection and reinjection of the oil substrate. The approach also results in no impact to ongoing range activities at operational DoD ranges.

Environmental Restoration ESTCP Project of the Year

Demonstration of In Situ Treatment with Reactive Amendments for Contaminated Sediments in Active DoD Harbors

*Dr. Bart Chadwick and Ms. Victoria Kirtay
Space and Naval Warfare Systems Command,
Systems Center Pacific (SSC Pacific)*

Successful delivery, placement and effectiveness of in situ treatment materials in active harbors has the potential to reduce costs, shorten recovery times and provide more

effective alternatives to traditional methods of remediation for a wide range of sites with contaminated sediments. Traditional remediation of sediments has involved removal by dredging or isolation by capping. Removal actions may cause increased mobility and bioavailability of contaminated sediments, while physical capping may not be practical in active harbors and navigable waterways.

Dr. Bart Chadwick and Ms. Victoria Kirtay from SSC Pacific led an ESTCP-funded project to demonstrate and validate the placement, stability and performance of reactive amendments for treatment of contaminated sediments in active DoD harbor settings.

The team successfully demonstrated in situ remediation of surface sediment contaminated with hydrophobic organic compounds by placing a reactive amendment consisting of powdered activated carbon (PAC). This was done at a site contaminated with polychlorinated biphenyls (PCB) located at the Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS & IMF) in Washington State. The PAC was successfully placed on the seafloor of a half-acre target site to sorb PCBs in sediments, thereby reducing bioavailability and limiting bioaccumulation of contaminants into the tissues of benthic invertebrates and subsequently the food web.

Prior to this project, the majority of in situ sediment amendment efforts have been small, pilot-scale efforts in areas without significant limitations to access and generally targeted to low velocity waters with minimal vessel traffic or harbor activities. This project achieved the key goal of extending pilot-scale efforts to larger scale footprints in active DoD harbor areas with the additional challenge of remediation in deep water with high vessel traffic.

Resource Conservation and Resiliency ESTCP Project of the Year

Demonstration and Implementation of Autonomous Aerial Acoustic Recording Systems to Inventory DoD Installation Impact Areas for Threatened, Endangered and Species at Risk Bird Populations

*Dr. David A. Buehler
University of Tennessee*

*Dr. Richard A. Fischer
U.S. Army Engineer Research and Development Center*

DoD manages millions of acres of land that are used for training and testing to ensure military readiness. These lands are unique in that large and inaccessible

This project team successfully demonstrated in situ remediation of surface sediment at PSNS & IMF in Puget Sound.
MCS Apprentice William Blees



parcels have been set aside as impact areas for various types of munitions and explosive ordnance. These areas are also highly suitable as habitat for many threatened, endangered and at-risk (TER-S) avian species across the country. DoD has responsibility to monitor for and manage these species, which has proven difficult due to the inability to access these restricted areas on the ground.

An ESTCP-funded project led by Dr. Richard Fischer of the U.S. Army Engineer Research and Development Center and Dr. Dave Buehler at the University of Tennessee aimed to assess the significance of inaccessible areas to TER-S bird populations. They have addressed the accessibility issue by using an autonomous aerial acoustic recording system (AAARS) composed of a weather balloon that transports an electronic payload over otherwise unreachable areas. The key functions of the payload are to record the vocalizations of the target avian species, provide tracking telemetry to spatially correlate the audio data, track the flight path of the system, control the altitude of the system and reliably and safely recover the system.

The benefits of this effort are widespread and will have a broad impact on the DoD community. Implementation of the AAARS will enable natural resources staff for the first time to inventory which species are present in inaccessible areas, estimate relative abundance and density of these species and track the status of the populations over time. This project will provide information that will significantly improve DoD's ability to comply with the Migratory Bird Treaty Act, National Environmental Policy Act, Executive Order 13186, the Endangered Species Act and, where applic-

The AAARS used to identify and characterize TER-S avian species in inaccessible locations.



able, the Migratory Bird Rule. Furthermore, monitoring TER-S in formerly inaccessible areas will directly support the objectives of the recent DoD Coordinated Bird Monitoring Plan that recommends focused monitoring on species that have the potential for future impacts to the military mission.

Weapons Systems and Platforms ESTCP Project of the Year

Comprehensive Evaluation and Transition of Non-Chromated Paint Primers

*Ms. Julia Russell
Ms. Brenna Skelley
Naval Air Warfare Center—
Aircraft Division
(Patuxent River, Maryland)*

Hexavalent chromium (chromate or Cr + 6) is the key component for high performance corrosion inhibiting primers used across DoD weapons systems and platforms. This known carcinogen has been targeted by DoD for reduction since 2009, which

resulted in a need to identify, test, validate and implement alternative technologies. Ms. Julia Russell, Ms. Brenna Skelley and their team from the Naval Air Warfare Center—Aircraft Division in Patuxent River, Maryland have developed a comprehensive evaluation protocol for development and application of non-chromate primers.

Since this project was conceived in 2011, the Naval Air Systems Command has led a joint service effort, focused on alternative materials performance across the wide-range of corrosive environments to protect both surfaces and interfaces. The team evaluated technically and commercially mature commercial-off-the-shelf products for large scale primer usage. Other lower technology-readiness-level non-chromate primer technologies also were investigated for their potential as chromate coating replacements. These coatings were demonstrated on operational military aircraft.



As a result of this effort, DoD has authorized reliable Type-I non-chromate primers on the outer mold line of various aircraft including the P-3 Orion, MQ-8 Fire Scout, F-15 Eagle, F-16 Fighting Falcon, UH-60 Black Hawk, E-2C Hawkeye, C-2 Greyhound, H-53 Helicopter and all Navy trainers. Multiple government and industry partners have each shown interest toward the adoption and implementation of non-chromate primers, reducing overall Cr + 6 use and likely elimination from some platforms and user facilities.

This effort demonstrated a method for evaluating both existing and future coatings to characterize the full range of their properties and determine their usefulness across all necessary applications. The outcome will provide the readiness of a given product for implementation or demonstration and validation, or recognize if additional investment is needed for optimization or concept development. Relative capability and maturity ranking will identify both the best state of the art for non chromate primers and technology gaps or requirement hurdles for developmental materials. A further benefit will be a final determination of those products that do not offer acceptable performance as a general chromate primer replacement, as well as those products that may only be acceptable for specific or limited applications based on reduced properties.

Environmental Restoration SERDP Project of the Year

Tracking the Uptake, Translocation, Cycling and Metabolism of Munitions Compounds in Coastal Marine Ecosystems Using Stable Isotopic Tracer

Dr. Craig R. Tobias
University of Connecticut

The explosives 2,4,6-trinitrotoluene (TNT) and RDX are common munitions constituents. Both compounds and their derivatives are U.S. Environmental Protection Agency (EPA) priority pollutants and are persistent in the environment. Within the contiguous 48 United States, there are approximately 41 active DoD installations located within the coastal zone. Exposure of marine/estuarine ecosystems at some sites is well documented, while other installations have a high potential for exposure but limited data on RDX or TNT concentrations in marine receptors. Coastal habitats are highly productive, nitrogen-limited and economically valuable ecosystems. Their response to munitions compounds and their effect on munitions cycling, persistence, bioaccumulation and mineralization are largely unknown.



Tidal wetting and drying of marsh plants was simulated in experimental tanks.

Dr. Craig Tobias from the University of Connecticut and his team led a SERDP-funded project that quantified the pathways and rates of RDX and TNT processing at three typical coastal ecotypes—subtidal vegetated, subtidal unvegetated and intertidal salt marsh. The team sought to understand the uptake rates of these compounds at the organismal to ecosystem scales, and which ecosystem components are important regulators of processing. In addition, the team investigated which ecosystem components act as zones of storage for munitions compounds versus those that promote metabolism, and whether ecosystem characteristics relate to processing or accumulation of munitions compounds. Finally, the team determined the extent which these compounds were mineralized to inert inorganic end products.

Study results have shown that TNT and RDX are processed in all ecotypes, and that while TNT loss is uniform across all sediment types, RDX loss is a function of organic matter content and redox conditions. The results also demonstrated that these parent munitions compounds and primary common derivatives are unlikely to persist in marine environments. The data from this study will provide a quantitative assessment of marine habitats as bioaccumulators or natural attenuators of munitions compounds.

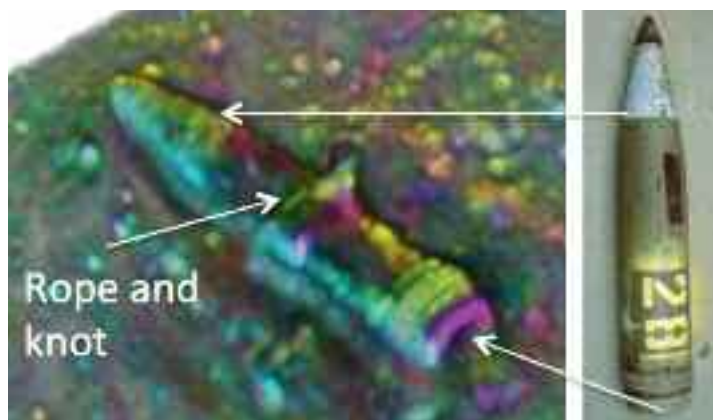
Munitions Response SERDP Project of the Year

Multi-pass and Non-concentric Target Circular Synthetic Aperture Sonar

*Dr. Jermaine L. Kennedy
Naval Surface Warfare Center
Panama City Division*

*Dr. Timothy M. Marston
University of Washington
Applied Physics Laboratory*

Circular Synthetic Aperture Sonar (CSAS) is a promising technique to classify and identify underwater objects, such as submerged or buried unexploded ordnance (UXO). It is easy to imagine CSAS being used to develop local training data to support acoustic surveys of the more than 400 Formerly Used Defense Sites that are potentially contaminated with submerged unexploded munitions. In the case of particularly high-value targets this technique may even be used for the survey. Dr. Jermaine Kennedy from the Naval Surface Warfare Center, Panama City Division and Dr. Timothy Marston from the University of Washington, Applied Physics Laboratory developed sophisticated sonar processing algorithms to produce acoustic images and thereby advance the usability of CSAS.



The CSAS technology is capable of producing detailed images using relatively low frequency underwater sound waves.

Sonar data was obtained from sample munitions and other objects in a variety of environments, ranging from flat and sandy seabed, to areas comprised primarily of rock, coral and complex limestone formations. These data were collected from an Autonomous Underwater Vehicle (AUV) instrumented with a dual-band sonar having a high frequency band in the hundreds of kilohertz (kHz) and a low frequency band in the tens of kHz. The sonar heads travelled along circular paths at different heights around each object. The researchers wrote software to estimate the three-dimensional (3D) position of the sonar head

using the sonar data itself, and developed new algorithms for coherently combining the data from the multi-pass scans to reconstruct 3D images of targets and measure their 3D acoustic frequency responses.

Significant challenges included compensating for spatial and temporal sound propagation speed variations, the complexity of the local seafloor and the 3D positioning uncertainties inherent to underwater navigation that complicated multiple pass synthetic aperture processing.

The results were impressive. Using relatively low frequency underwater sound waves, their techniques allowed video-quality figures to be produced. This work will generate an acoustic training database, enabling eventual use by commercial UXO survey contractors.

Resource Conservation and Resiliency SERDP Project of the Year

Deep Mapping of Teuthivorous Whales and Their Prey Fields

*Dr. Kelly J. Benoit-Bird
Oregon State University
Monterey Bay Aquarium Research Institute*

Recent research and development efforts have helped to greatly expand the understanding of both the behavior and biology of deep-diving marine mammals. There have been several studies of the physical habitat of these deep-diving predators but our understanding of the available prey, a key component in the biological habitat of these animals, is not as well developed. The main prey of these marine mammals are squid and they have proven to be difficult to study due to their rapid speed, relatively large size and depth range.

A SERDP-funded project led by Dr. Kelly J. Benoit-Bird from Oregon State University and the Monterey Bay Aquarium Research Institute and her team aimed to address this gap in research through the development of a new platform to carry the acoustic instruments needed to assess squid and then utilize the tool to understand the foraging ecology of deep-diving teuthivores (squid eaters). Study efforts targeted habitat used differentially by deep-diving, air-breathing predators (beaked whales and Risso's dolphins were chosen as the study subjects) to empirically sample their prey's distributions on and off a Navy testing range. Dual-frequency (38 and 120 kHz) split-beam echosounders were integrated into a REMUS 600 AUV, effectively doubling the

An improved understanding of marine mammal prey will help DoD better manage interactions with these creatures.



range of quantitative, multifrequency acoustic data into the mesopelagic zone (600 to 1,200 meters in depth).

Results of this project showed significant spatial variability in the size, composition, total biomass and spatial organization of biota over all spatial scales examined and was consistent with the general distribution patterns of foraging Cuvier's beaked whales observed in separate studies. Remarkable differences were found in prey characteristics between regions at depth, changes that were unobserved in surface layers. The revelation that animals deep in the water column are so spatially heterogeneous at scales from 10 meters to 50 kilometers critically affects the understanding of the processes driving predator-prey interactions, energy transfer, biogeochemical cycling and other ecological processes in the deep sea along with the connections between the productive surface mixed layer and the deep-water column.

The research team also explored the behavior of Risso's dolphins foraging in somewhat shallower scattering layers off Santa Catalina, California using a similar approach. Active acoustic measurements demonstrated that Risso's dolphins dove to discrete prey layers throughout the day and night with only slightly higher detection rates at night.

Dolphins were detected in all three layers during the day with over half of detections in the middle layer, 20 percent of detections in the deepest layer and 10 percent falling outside the main layers. Dolphins were found less frequently in areas where the shallow, intermittent layer was absent, suggesting that this layer, though containing the smallest prey and the lowest densities of squid, was an important component of their foraging strategy. The technology and approaches used in this project are already being transitioned to additional applications within the marine mammal community.

Weapons Systems and Platforms SERDP Project of the Year

Cyanate Ester Composite Resins Derived from Renewable Polyphenol Sources

Dr. Benjamin Harvey

*Naval Air Warfare Center—Weapons Division
(China Lake, California)*

Carbon fiber polymer composites are important structural materials for weapon systems and aerospace platforms. They provide remarkable strength, reduced susceptibility to corrosion and significant weight reductions compared

to aluminum. This allows for enhanced warfighter capability, reduced fuel usage and enhanced resistance to corrosion, thereby greatly reducing lifecycle costs.

Most thermosetting resins are synthesized from phenols that are generated from unsustainable petroleum sources by multi-step routes that are energy and solvent intensive. Further, many of the precursors to conventional thermosetting resins have estrogenic effects and toxicity issues. To address these environmental challenges while increasing the availability of sustainable, domestic sources for high temperature materials, Dr. Benjamin Harvey and his team from the Naval Air Warfare Center - Weapons Division (China Lake, California) developed new methods to efficiently convert bio-based feedstocks to polyphenols and thermosetting resins that in many cases outperform petroleum based materials.



A hydrophobic thermosetting resin generated from pine resin displays remarkable properties.

New thermosetting polymers have been prepared from vanillin and creosol—two molecules that can both be readily derived from lignin. In addition, a liquid, highly processable monomer has been derived from anethole, a significant component of pine resin and the essential oil of star anise. Another avenue of research has focused on the conversion of eugenol, the main component of clove oil, into thermosetting polymers, polycarbonates and homogeneous network structures.

As a key example of the remarkable properties afforded by these bio-based materials, a hydrophobic polymer has been synthesized from pine resin that exhibits one of the lowest water uptakes ever measured for this class of materials and

SERDP and ESTCP are DoD's environmental research programs, harnessing the latest science and technology to improve DoD's environmental performance, reduce costs and enhance and sustain mission capabilities.

thermomechanical properties that are unaffected by exposure to boiling water for four days. This remarkable material has obvious applications for use in maritime environments.

In one of the most exciting and innovative facets of this work, biosynthetic phenols are being used as precursors to thermosetting polymers. In collaboration with industrial partners, the phenols are generated from biomass sugars via fermentation with metabolically engineered organisms. A key example of this technology is the development of a thermosetting resin from the trisphenol resveratrol. The derivative polymer has a glass transition temperature of 350 degree Celsius, a char yield in air of greater than 70 percent, and the lowest heat of combustion (2.5 kilojoules/gram) recorded to date for an organic polymer. Polymer composites prepared from resveratrol are of significant interest for missile cases, high temperature structural components and fire resistant coatings.

Several of the resins developed through this project have been incorporated into both flat panel laminates as well as bulk molding compounds (BMC) that can be fabricated into virtually any shape. Bio-based BMCs have been used to fabricate composite polar bosses (rocket case connectors) that are roughly half the weight of conventional aluminum polar bosses. The simple and efficient BMC fabrication process is expected to greatly reduce the cost and lead time of these components.

In addition to the remarkable material properties of the bio-based polymer composites, initial computational studies predict that many of the bio-based polyphenols will not bind to the estrogen receptor site making them safer to use for both thermosetting and thermoplastic polymer applications. Further, studies have shown that some of the bio-based thermosetting resins can be partially recycled by pyrolysis under humid conditions.

About SERDP & ESTCP

SERDP and ESTCP are DoD's environmental research programs, harnessing the latest science and technology to

improve DoD's environmental performance, reduce costs and enhance and sustain mission capabilities. SERDP and ESTCP respond to environmental technology requirements common to all of the military Services, complementing the Services own research programs. The programs promote partnerships and collaboration among academia, industry, the military Services and other Federal agencies. Investments are managed in five program areas:

1. Energy and Water
2. Environmental Restoration
3. Munitions Response
4. Resource Conservation and Resiliency
5. Weapons Systems and Platforms

SERDP and ESTCP are independent programs managed from a joint office to coordinate the full spectrum of efforts, from basic and applied research to field demonstration and validation.

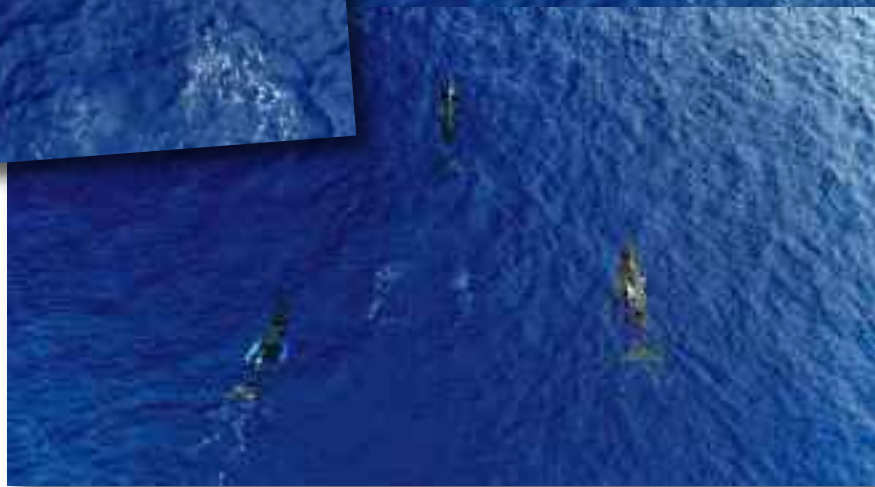
SERDP is DoD's environmental science and technology program, planned and executed in partnership with the Department of Energy and the EPA, with participation by numerous other Federal and non-Federal organizations. The program focuses on cross-service requirements and pursues solutions to the Department's environmental challenges while enhancing and sustaining military readiness.

ESTCP is DoD's environmental technology demonstration and validation program. Project researchers conduct formal demonstrations at DoD facilities and sites in operational settings to document and validate improved performance and cost savings. Demonstration results are subject to rigorous technical reviews to ensure that the conclusions are accurate and well supported by data.

For more information, visit www.serdp-estcp.org. 

Jeffrey Houff
SERDP and ESTCP Support Office
703-610-2709
Jeffrey.Houff@noblis.org

SOME OF MY Best Shots



I captured these images of humpback whales (*Megaptera novaeangliae*) during their annual winter migration to mate and give birth in the warmer waters off Kailua Kona, Hawaii. The images were taken using a DJI Phantom 4 Pro quadcopter drone with a 4k camera.

Greg Chavdarian ● aerialgreg@gmail.com ● Instagram: @aerialgreg

Editor's note: These photos demonstrate how changing technologies, when used responsibly, can bring us all new views of the world. Show us your own view by submitting your Best Shot!

Submit your own Best Shot to Bruce McCaffrey ● *Currents'* Managing Editor ● brucemccaffrey@sbcglobal.net

Kenneth Hess
CNO Energy and Environmental Readiness Division (Code N45)
2000 Navy Pentagon, Room 2E258
Washington, DC 20350-2000

OFFICIAL BUSINESS

CHANGE SERVICE REQUESTED

